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THE MAGAZINE OF APPLIED ENGINEERING

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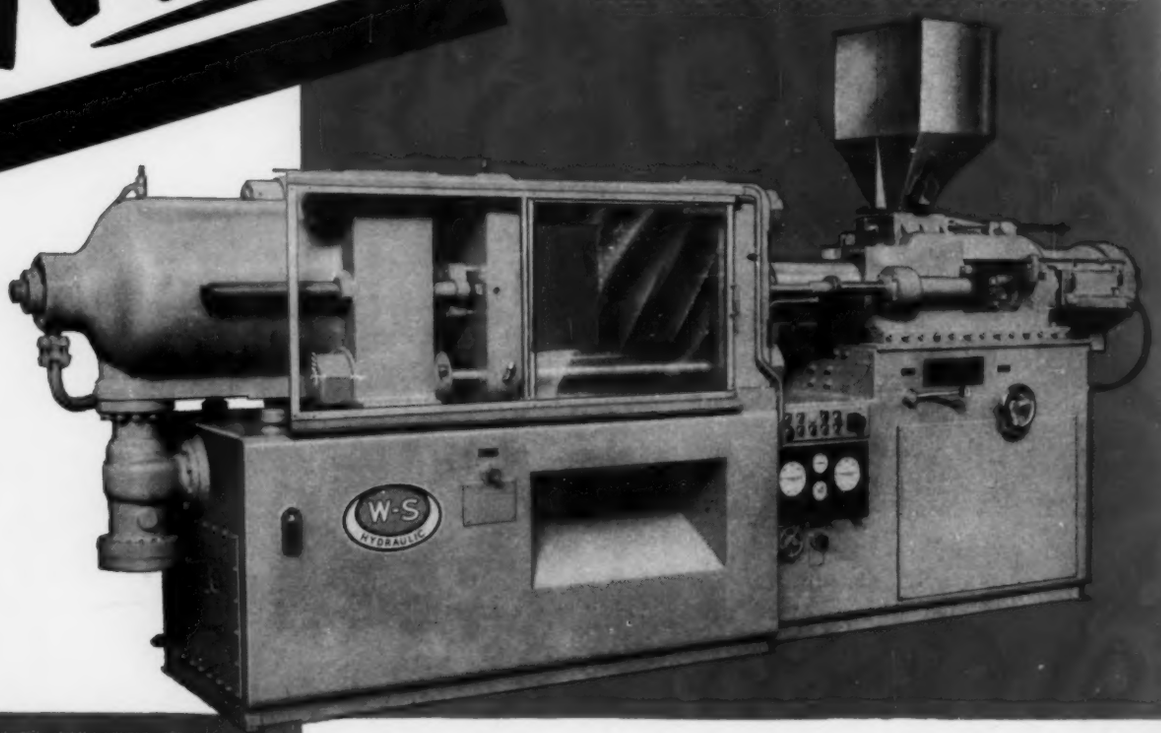

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THE MAGAZINE OF APPLIED ENGINEERING

PLASTICS TECHNOLOGY

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VOLUME 1, NUMBERS 11 & 12

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REINFORCED PLASTIC HOUSINGS FOR MACHINE TOOLS 695

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Chairman of the Board, Raymond Bill. President, Edward Lyman Bill. Treasurer, Ralph L. Wilson. Vice Presidents, B. Brittain Wilson, C. Ernest Lovejoy, Wm. H. McCleary. Editorial and Executive Offices, 386 Fourth Ave., New York 16, N. Y. LExington 2-1760. *Subscription Price:* United States and Possessions and Canada, $4.00 per year. All other countires, $8.00. Single copies in the U. S. 50¢; elsewhere, 75¢; *Other Bill Brothers Publications:* In Industry: Rubber World. In Marketing: Sales Management, Sales Meetings, Premium Practice. In Merchandising: Floor Covering Profits, Fountain & Fast Food, Grocer-Graphic, Tires-TBA Merchandising, Yankee Grocer.

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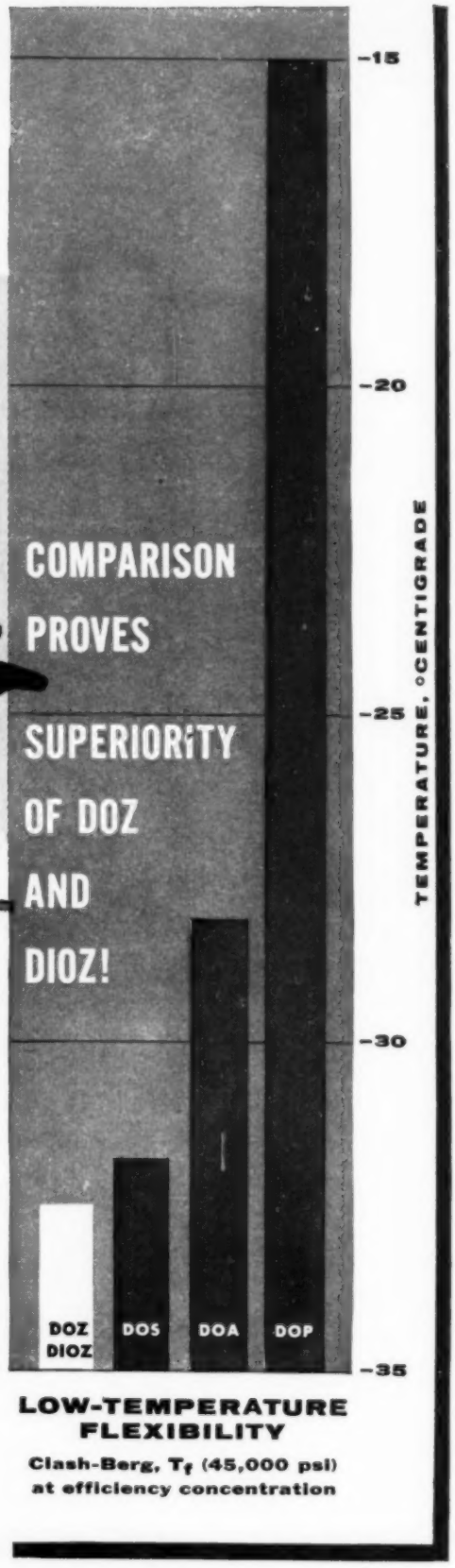

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Letters to the Editor

Another Bouquet

Dear Sir:

May I be permitted to say that I and other members of our Research Department have found your new publication to be most informative and well written. We feel that it has an important place to fill in the dissemination of knowledge in the plastics industry.

Paul Robitschek, Research Department
Hooker Electrochemical Co.
Niagara Falls, N. Y.

• • •

Who Makes Epoxy Stabilizers?

Dear Sir:

In your July issue, page 371, you mentioned that a French firm has developed an epoxy stabilizer. We are interested in obtaining a sample of this material, and wonder if you could give us the name and address of this company in France that makes the stabilizer.

Gerry T. Mack
M & T Laboratories, Inc.
New York, N. Y.

(The write-up was based on an item that appeared in a French publication, "Plastiques Informations," who should be contacted for further information on the manufacturer of the stabilizer.—Editor)

• • •

Polyethylene-Vinyl Mix-Up

Dear Sir:

We believe there is some kind of a mix-up in the last sentence of the last paragraph in the item "Nopco Presents Expansion Plans" on page 566 of the October issue under News of the Industry.

It seems to me that this sentence should relate to vinyl foams as does the rest of the paragraph. On the other hand, it is not quite correct to refer to vinyl as a high-density product since it has been made at densities less than four pounds per cubic foot, and is currently being made commercially in the 5-7 pound density range. The error is not a serious one, but we thought it should be called to your attention.

Henry E. Allen, Vice Pres.
Elastomer Chemical Corp.,
Newark, N. J.

(The paragraph in question reads as follows: "Foamed vinyl was said to be a suitable companion for the polyurethanes, since sponge and foam rubber's shortcomings reportedly are not encountered in this product. A market potential of 170-million pounds has been estimated by 1960. Offering a high density product at low cost, the urethane foams are non-flammable."

This paragraph was cut to fit the page in the News section, which explains the misunderstanding it may arouse. Actually, the last two sentences in the paragraph refer to polyurethane foams, and not to vinyl foams.—Editor)

• • •

How About Extruded Vinyl Film?

Dear Sir:

I have read the article "Vinyl Calendering and Plastisol Technology" in the September issue.

It is very interesting to note how the gentlemen from Monsanto glossed over the subject of extruded vinyl film. I would assume that on the standards of the calendering industry the resin consumed in vinyl extruded film is only a drop in the bucket. However, extruded film is being manufactured by the Clopay Corp. in several grades and several thicknesses. It is being used in the packaging field, for storm windows, and miscellaneous fabrication applications.

I also believe that this type of film is being manufactured by both Goodyear Tire & Rubber Co. and General Tire & Rubber Co. It would seem logical that these manufacturers are not using Monsanto's resin, and Clopay is not, so it may be that the authors had no knowledge of the uses or manufacturers. If the authors had no knowledge of the uses or manufacture of this material, they should have left out the reference.

Actually, it is my recollection that much of the early work and publicity on blown extrusion film is credited to the Naugatuck Chemical Division, U. S. Rubber Co. Clopay has extru-

ed both vinyl film and sheeting since about 1951.

As for plastisol cast unsupported films, they are used in many applications other than for storm windows. The major portion of the plastic adhesive bandages and many other industrial tapes are manufactured from cast film because of its freedom from strains normally found in calendered film. Many decorative films are made from various types of supported cast films. Their chief use has been in luggage, table tops, wall coverings, special wrap, notebook covers, and other similar uses. The particularly good abrasion resistant properties of vinyl make them well suited to the above and many similar applications.

D. S. Threlkeld, Dir. of Research
Clopay Corp., Cincinnati, Ohio

• • •

"Durcon" Identified

Dear Sir:

Our attention has been directed to your October issue which carried a letter from the Signal Trainer Co. requesting information about the producer of a polyethylene plastic under the trade name "Durcon."

Durcon is a registered trade name owned by The Duriron Co. and covering a family of plastics. Durcon products include pumps, valves, pipe, fittings, etc., for handling corrosive fluids. At the present time, Durcon is essentially an epoxy resin modified to our requirements. It is not available as a polyethylene.

We have already written to the Signal Trainer Co. informing them of our Durcon and the possibility of its application to their problem.

R. M. Shields
The Duriron Co., Inc.
Dayton, Ohio

• • •

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation, and address.

Letters requesting information on technical or engineering problem swill be printed to elicit replies by the readers, either directly or through these columns. Upon request the identities of such "problem" letters will not be divulged.

—The Editor

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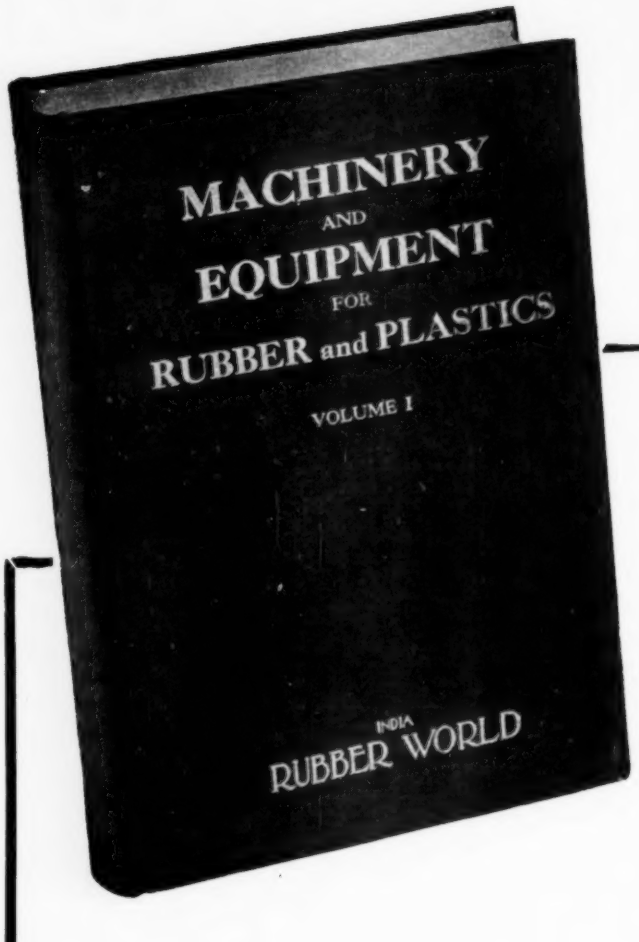

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Plastics Trend in Building

"Functional design is the magic phrase of modern building. Home design has undergone radical changes, and the trend in commercial and industrial construction has been toward a wedding of functionality and beauty. Ornamentation for the sake of ornamentation is no longer considered a valid concept of modern design. Nor on the other hand is the structurally sound but unappealing type of construction finding general favor today. Today's building materials must be efficient. At the same time, they must be appealing.

"These changes . . . have caused a tremendous upsurge in the search for new materials which can efficiently and economically meet the challenge. Among the many materials which have been and are being investigated, plastics as a general class seem to offer the most promising combination of the necessary characteristics. Long service life, reduced maintenance costs, lightweight strength, choice of color, and, in many cases, ease of fabrication are the deciding factors in their selection as building materials.

"The so-called 'plastic dream house' will not be a standard sales item in 1956. However, the steady increase of plastics for decorative building applications indicates the pendulum of usage is swinging towards plastics and their man-made properties of efficiency, economy and beauty."

W. J. Connelly, Asst. Dir. of Public Relations
Bakelite Co., New York, N. Y.

• • •

Canadian Chemical Industry

"American capital invested in Canada at the end of 1954 . . . is four times as much as the next ranking foreign country, totalling nearly $6-billion, or approximately 30% of the total which Americans have invested abroad. This shows the extent to which the U.S.A. has contributed to our development.

"The chemical manufacturer in Canada faces a difficult situation because of limited home markets. For example, the Canadian consumption of a given product may be, say, six or eight million pounds per year. To be competitive with foreign producers and imports, the Canadian manufacturer, therefore, must of necessity obtain the whole market. (If he finds) he can only supply a share of the market, he is eliminated by excessive production costs due to being forced to operate at a reduced rate of production."

Victor G. Bertram, President
Shawinigan Chemicals, Ltd.,
Shawinigan Falls, Que., Canada

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SAVINGS: SHORE-CALNAVAR METAL PRODUCTS CO. reports only 2½ hours needed to produce the tool which was used for polishing 26,000 parts. This was a saving of 80% over conventional type tooling.

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WHEN HOUSEWARE SETS WERE BAGGED IN POLYETHYLEN FIL

Housewares molded of colorful Monsanto polyethylene are so attractive they are usually displayed on counters and left to sell themselves.

But dramatic things happened when one manufacturer tried the idea of packaging sets of housewares in printed polyethylene film bags . . . "Our sales in these items rose a phenomenal 1200%," says John Harkless, Sales Manager of Rogers Plastic Corporation, West Warren, Mass.

"The soft transparency of the polyethylene film makes the merchandise inside easily visible and far more appealing to the impulse shopper. But, more important, we can now design our line for higher unit sales, which is what every

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resi
sion

*Last

s building multiple profits!

store manager wants. In addition to providing handsome packages, the polyethylene bags give the customer more re-use benefits, since they are tasteless, odorless, flexible and durable."

This is how the Rogers housewares line, one of the most extensive in the industry, met the demands of super merchandising.

For other profit building ideas on how you can upgrade your product lines with Monsanto polyethylene molding and film resins, write to Monsanto Chemical Company, Plastics Division, Dept. PT-12, Springfield 2, Massachusetts.

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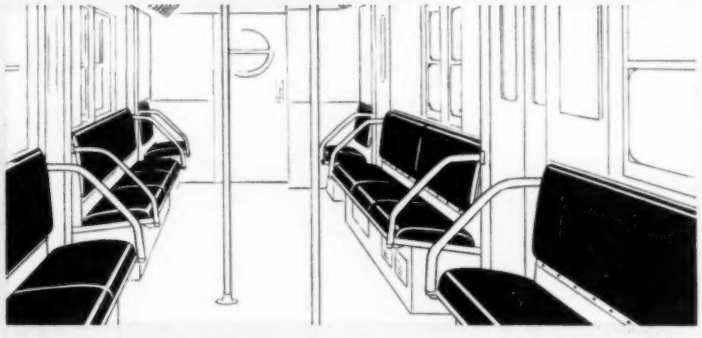

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NEWS in BRIEF

Plastics usage in building is estimated at approximately 400-million pounds each year, according to the National Association of Home Builders, emphasizing the contribution of plastics to modern home construction. Building usage of plastics in 1955 is estimated near $240-million.

1956 National Plastics Exposition, to be held in New York City on June 11-15, expected to set new records in number of exhibitors and attendance. Indications are that the exhibitors will number 250 by the time the exposition opens, and attendance at the show is expected to total over 20,000.

Plastics molders must constantly search for improved materials and product designs, and lower manufacturing costs, says J. L. McMurphy, general manager of General Electric's plastics dept. (see guest editorial, page 685). G-E uses "value analysis," the focussing of engineering, manufacturing, and purchasing attention on obtaining product performance at lower cost.

Mobay's isocyanate plant and lab is in operation. Units to make special polyester chemicals began operating last month; the balance of the plant, to make isocyanate chemicals, begins production this month; and the urethane research labs are in complete operation.

Low-pressure polyethylene by the Phillips process has been licensed by Union Carbide, which also holds a license under the Ziegler method. The low-pressure polyethylenes made by the two processes differ somewhat in certain properties. Carbide is the world's largest producer of high-pressure polyethylene, with a total annual productive capacity of more than 285-million pounds, including a plant still to come on stream.

Cellulose propionate plastic production has been inaugurated by Celanese at its Belvidere, N, J., plant. The new thermoplastic gives the firm another line in addition to cellulose acetate, polyethylene, PVA emulsions, and polyester resins.

Company expansions in plastics continue unabated. Borden plans a 25% production increase in its Illiopolis, Ill., resin emulsions plant; a new water-base paints service lab in Los Angeles, Calif.; and a new formaldehyde plant in Seattle, Wash., with an annual capacity of 36-million pounds. A new $3½-million plant for Geon vinyl resins will be built by Goodrich Canada near Welland, Ont. Holiday Plastics leased new production facilities in Kansas City, Kan. New facilities to triple production of vinyl paste resin are being built by Monsanto at Springfield, Mass. Phillips Chemical is erecting a sales service lab for Marlex polyethylene at Bartlesville, Okla. A new office-warehouse building near Chicago, Ill., will be put up by Rohm & Haas. The first commercial plant for isosebacic acid will be erected at Tuscola, Ill., by U. S. Industrial Chemicals.

New Materials worthy of mention (see page 708): a curing agent for epoxy resins; four new PVC resins; ultra-fine color dispersions; plasticizer for nitrocellulose lacquers; high-dielectric plastic foams; and primary and secondary plasticizers for vinyls.

New Equipment to be noted (see page 710): polymer process control unit; powder dispersing and confining machine; automatic silk-screen printing presses; high-speed automatic compression presses; thermocouple-type injection test nozzle; plastic-covered conveyor pulleys; and a two-stage hydraulic press for testing, laminating, and molding.

New Products that merit attention (see page 712): plastic protective goggles; glass-reinforced polyester truck covers; vinyl markers for traffic lines; nylon boggins for wire-braiding machines; vinyl plastisol strip-coating; epoxy adhesive; reinforced plastic chair bodies; and a polyethylene-textile fabric having a 3-D effect achieved by controlled shrinkage.

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PLASTICS TECHNOLOGY

DECEMBER, 1955

EDITORIAL: The Outlook for 1956

All indications for 1956 call for continuing expansion and growth of the plastics industry, with increases in production and sales volumes. Since plastics are part of the chemical industry picture, any forecast of prospects for the coming year should properly begin with the outlook for the chemical industry.

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Growth prospects for the chemical industry in 1956 remain as bright as ever. Chemical business should continue on a high level, especially during the first half of the year. A slight decline is anticipated during the second half of 1956, but the over-all volume for the year is expected to be high as new products and new uses for older products continue to be developed.

The chemical industry has spent more than $10-billion on new plants and equipment since the end of World War II, and outlays in 1955 for this purpose are expected to total more than $1-billion. The stimulus of rapid tax amortization no longer being available for most purposes, expenditures for new plants may show some decline in 1956, but the quick-changing technology of the chemical industry will continue to demand large plant outlays.

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The continuing boom in plastics for 1956 is expected to be led by polyethylene and the low-pressure reinforced plastics. The growth curve in polyethylene production and use over the past few years justifies its predicted appellation of the first billion-dollar per year plastic. Further strides towards this goal are expected in 1956, with added impetus being provided by the advent of the new low pressure ethylene polymers.

Reinforced plastics, with epoxies continuing to gain on the polyesters, are expected to make further gains in tooling, aircraft, automotive, and building applications.

These and other uses of all plastics during the coming year can be expected to continue the ever-growing trend towards the use of plastics in engineering applications.

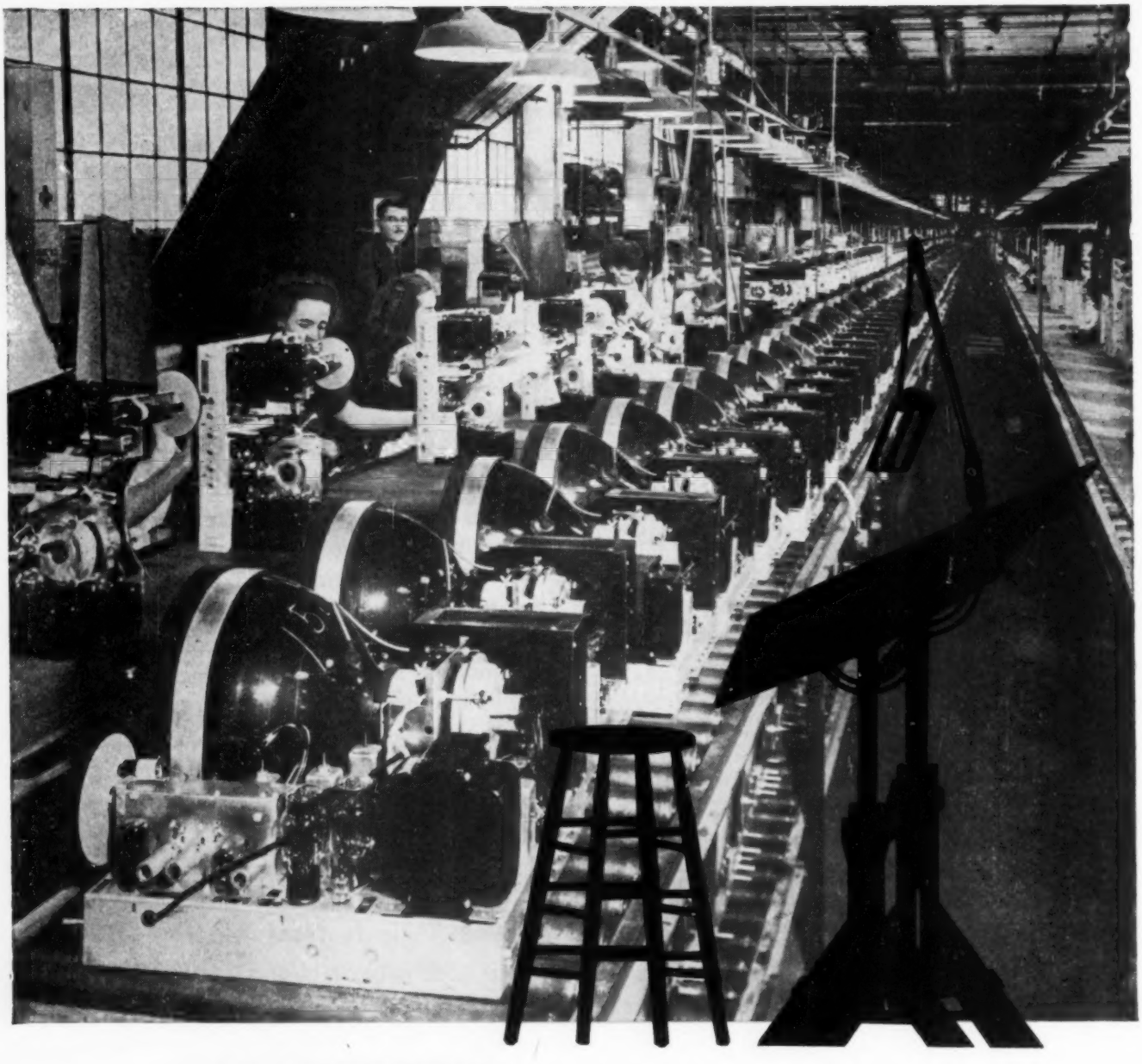
Volume 2 starts Next Month

Our next issue, January 1956, will be Volume 2, Number 1 of PLASTICS TECHNOLOGY. Since we began publication last February, Volume 2 normally would begin with our February 1956 issue. However, repeated requests have been received from our readers that our volumes be on a calendar year basis, and we are pleased to accede to this suggestion. Accordingly, this issue is Volume 1, Numbers 11 & 12, thus clearing the way towards making the January issue the start of Volume 2.

As we have said in the past, this is *your* magazine and we will make every effort to incorporate all suggestions that will increase its value to the readers.

Arthur M. Merrill

Editor



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STUBBORN . . . How long would your production lines run if you froze your designs today? Two years? Three years? No matter how good your products, you must constantly improve them. Such is the stubborn law of competition. For this, America will need many more young professional engineers and scientists—for many years to come. For this, more young people in high school must be encouraged to prepare themselves for entrance into our engineering colleges. A good beginning has been made by many companies and by the Advertising Council's "Engineers Wanted" Campaign. Your company, too, can help promote engineering as a career. To learn more about the Advertising Council and its "Engineers Wanted" Campaign, write for the booklets "The Advertising Council, What it is—What it does" and "How your company can help promote engineering as a career."

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Stabilizers for Vinyl Chloride and Its Copolymers—Part II

The conclusion of a two-part article giving an exhaustive and critical examination of the many different types and classes of vinyl stabilizers, their features, properties, and applications.

Heavy Metal Soaps

Zinc compounds have long been avoided by vinyl compounders because of the known catalytic effect of metallic zinc on polymer degradation. However, it has been found that metal-free zinc soaps are safe when very small quantities are used with a chelater in an epoxy-type formulation. These metal-free zinc soaps are of little interest when used alone as stabilizers. Their main action is that of decolorizing the decomposition products of the other stabilizer used. Yellowing and sulfur staining may be reduced to a great extent by the addition of zinc soaps to the formulation. Their cheapness, non-toxicity, and non-sulfur staining properties have lead to the development of useful mixtures with alkaline earth metal salts, particularly barium. It is important that the ratio of zinc to barium be closely controlled.

Cadmium stabilizers are remarkable for the high degree of clarity which may be obtained with fairly small doses. Cadmium naphthenate, ricinoleate, stearate, and 2-ethyl hexoate are good light stabilizers for most resins. Their main disadvantages are relatively high price in relation to efficiency, toxicity, and tendency to stain yellow in sulfurous atmospheres. Generally speaking, with the exception of cadmium laurate, they are not very satisfactory with phosphate plasticizers. With few exceptions, they have poor heat stability which is characterized by the plastic material darkening to a brown or pitch black upon relatively short exposure to heat. The cadmium soap anion shows the following order of decreasing effectiveness: laurate, palmitate, stearate, ricinoleate, and octoate. Cadmium stabilizers are most efficient when used in an epoxy-chelater type of formulation.

Lead stabilizers were among the first to be used with polyvinyl chloride. As a class, they are good acid acceptors, and have good electrical properties and excellent lubricating qualities. Their chief drawbacks are a high reactivity with plasticizers and other compounding ingredients, poor color stability, toxicity, unsuitability for transparent compounds, and tendency to stain in sulfurous atmospheres. Even with the many drawbacks, a great majority of vinyl compounds are still lead stabilized, especially in electrical applications where toxicity and clarity are not important. Lead stabilizers tend to combine with sulfur and stain in the following descending order: dibasic lead stearate; basic lead carbonate; dibasic lead phosphite; dibasic lead phthalate; normal lead carbonate; and lead silicate.

Organic tin compounds are widely used as stabilizers for vinyl compounds requiring crystal clarity, resistance to sulfur staining, and excellent light stability. Among the tin compounds widely used for these purposes are dibutyl tin dilaurate and dibutyl tin maleate. Objections to the use of tin compounds are their relatively poor heat stability, poor odor, and high cost.

It is of interest to note that one stabilizer supplier has introduced a barium-cadmium-zinc system which is claimed to offer the advantages of tin without the objections. This system is said to offer excellent heat and light stability, clarity, and freedom from sulfur-stain.

Another group of tin compounds are the tin mercaptides. The heat-stabilizing action provided by these compounds cannot be matched. Accordingly, they are being used for such difficult jobs as the extrusion of rigid vinyls, and the blow extrusion of thin-gage vinyl film. Disadvantages of the tin mercaptides are poor light stability, very poor odor, high cost, and the danger of cross-staining in the presence of other vinyl products containing lead or cadmium salts.

Zinc stearate is an extremely efficient lubricant. Its stabilization properties resemble those of cadmium stearate, but are inferior to them. It should give good results when used in combination with calcium or magnesium soaps for non-toxic applications. A further increase in the heat stability of such a mixture is obtained by the addition of an epoxy compound.

Zinc laurate is not commercially available, but a mixed zinc-strontium and zinc-barium laurate can be obtained. They are said to be non-staining stabilizers, and can be used with other stabilizers in an epoxy and/or chelating-type formulation.

Zinc 2-ethyl hexoate is similar to the stearate, but has less lubricating power. It is used sometimes in combination with barium soaps in an epoxy formulation, and in some cases such combinations are more effective than the more usual cadmium-barium mixture. Here, again, it is highly important that the proper ratios be determined for each formulation and specific application. A good non-toxic stabilizer system can be made with the zinc-calcium combination that approaches the combination of barium and cadmium in efficiency.

Cadmium stearate is used alone for the production of transparent compounds in doses of about 1.0 part per 100 parts resin. Phosphate plasticizers should not be used with it, and the compound should be formulated at temperatures below 350° F.

Cadmium ricinoleate is the best of the ricinoleates as a light stabilizer. Unlike the stearate, it is seldom used alone, but rather in combination with barium ricinoleate. It is not very satisfactory with phosphate plasticizers.

Cadmium laurate is probably the best of the laurate stabilizers and, unlike the other cadmium stabilizers, is satisfactory with phosphate plasticizers.

Cadmium 2-ethyl hexoate is inferior to the stearate as a heat stabilizer but is more compatible and, therefore, a better base for synergetic mixtures where its inferiority is not apparent. It is an excellent light stabilizer and, as such, is used in combination with heat stabilizers such as barium, or in an epoxy-chelater system. In combination with tin compounds, it gives a stock of outstanding clarity and freedom from color.

Cadmium naphthenate is similar to the ricinoleate in stabilization, and preferred for organosol work because of its greater solubility in ketones. The great drawbacks are its very unpleasant odor and darkening due to the naphthenic portion.

Cadmium 2-ethyl hexoate-naphthenate mixtures are used particularly as the light stabilizer component of systems in which barium soaps or epoxies act as the heat stabilizer. They are more efficient with homopolymer than with copolymer resins, and are not very satisfactory with phosphate plasticizers.

Lead stearate is an efficient heat stabilizer and a good lubricant at moderate processing temperatures. It considerably opacifies the compound due to the high refractive index of the lead chloride formed by the interaction of the stabilizer with the hydrochloric acid evolved by the polymer during heat breakdown. This is, however, of no significance in the manufacture of opaque compounds. Lead stearate shows synergistic activity with a small trace of cadmium stearate, and with epoxy resins or plasticizers. Supplementary light stabilizers, such as tin or sodium salts, normally are used with this soap.

Photos courtesy of Argus Chemical Corp.

Fig. 3. Actual outdoor weathering is one of the best criteria for predicting a vinyl compound's useful service life.

Dibasic lead stearate does not melt even at the highest vinyl processing temperature, consequently it is a very good lubricant, especially for extrusion compounds. Dibasic lead stearate is superior to ordinary lead stearate as a heat stabilizer, and is preferable to it in the presence of phosphate plasticizers. It produces a slightly more cloudy product in standard formulations than does normal lead stearate, but gives clear amber stocks in the presence of petroleum-type plasticizer extenders. One of its main disadvantages is that it reacts with sulfur to form a dark, insoluble sulfide, as do the other lead and cadmium salts to a lesser extent. Over-use of lead stearate will result in poor printing and heat-sealing properties, so a maximum addition of 1% is usually recommended.

Lead 2-ethyl hexoate is similar to lead stearate but, owing to its lower lubricating action, is more suitable for stocks to be printed or welded. It offers protection during periods of high temperature for a short period of time.

Basic lead carbonate (white lead) is the most important of the lead stabilizers in terms of tonnage. It should be noted that only the hydroxyl group can be used as an acid neutralizer; otherwise evolution of carbon dioxide will occur and result in a porous compound. For this reason, it is usual to employ very large doses of the material; in the order of eight parts per 100 parts resin. Since lead carbonate is cheaper than either polymer or plasticizer, there is an incentive for this practice, except where the sales price is related to volume rather than weight.

Unfortunately, basic lead carbonate is not a light stabilizer, and in the presence of phosphate plasticizer seems to actually increase the sensitivity of the compound

Table 2. Alkaline Earth Metal Soap Stabilizers

Chemical Name	Trade Name	Manufacturer	Physical Form	Density or Sp. Gr.
Magnesium Compounds:				
Magnesium stearate	—	Advance Solvents	Powder	—
" "	—	Syn. Prods. Co.	Powder	1.04
" "	—	Witco Chem. Co.	Powder	1.03
Calcium Compounds:				
Calcium stearate	Advastab CS	Advance Slvents	Powder	1.035
" "	Harshaw 5V2	Harshaw Chem. Corp.	Powder	1.040
" "	Harshaw 5V22	" " "	Powder	1.021
" "	—	Metasap Chem. Co.	Powder	1.035
" "	Calstar	Natl. Lead Co.	Powder	1.04
" "	Nuostabe V60	Nuodex Prods. Co.	Powder	1.0
" "	—	Syn. Prods. Co.	Powder	1.04
" "	—	Warwick Chem. Co.	Powder	—
" "	Stayrite 25	Witco Chem. Co.	Powder	1.03
Calcium zinc stearate	Harshaw 59V5	Harshaw Chem. Co.	Powder	—
" " "	Stayrite 90	Witco Chem. Co.	Powder	1.05
Calcium ricinoleate	—	Baker Caster Oil	Powder	1.09
" "	Ferro 621	Ferro Chem. Corp.	Powder	—
Calcium ethyl acetoacetate	C-2	Carbide & Carbon	Powder	—
Calcium silicate	Silene EF	Columbia Southern	Powder	2.1
Strontium Compounds:				
Strontium stearate	—	Argus Chem. Corp.	Powder	—
" "	—	Mathe Chem. Co.	Powder	—
" "	—	Metasap Chem. Co.	Powder	—
" "	Nuostabe V-70	Nuodex Prods. Co.	Powder	1.1
Strontium ricinoleate	Ferro 400	Ferro Chem. Corp.	—	—
Strontium naphthanate in plasticizer	Advastab SN	Advance Solvents	Liquid	1.06
Strontium naphenate in methyl isobutyl ketone	Advastab V-1-N	Advance Solvents	Liquid	0.960
Strontium naphthenate	—	Mathe Chem. Co.	—	—
Barium Compounds:				
Barium stearate	—	Advance Solvents	Powder	1.230
" "	Harshaw 1-V-3	Harshaw Chem. Co.	Powder	1.11
" "	—	Metasap Chem. Co.	Powder	1.45
	Synpron barium stearate	Syn. Prods. Co.	Powder	1.15
" "	—	Warwick Chem. Co.	Powder	—
" "	Stayrite #20	Witco Chem. Co.	Powder	1.23
Barium ricinoleate (modified)	Staflex QYMA	Deecy Prods. Co.	Paste	—
" " "	Baker BVS	Baker Castor Oil	Powder	1.21
" " "	Ferro 120	Ferro Chem. Corp.	Granular solid	—
" " "	Ferro 121	Ferro Chem. Corp.	Viscous liquid	1.13
" " "	Harshaw 1-V-1	Harshaw Chem. Co.	—	1.13
" " "	Nuostabe V-10	Nuodex Prods. Co.	Powder	1.1
" " "	Barinac	Natl. Lead Co.	Powder	1.23
Organic barium complex	Advastab BA-13P	Advance Solvents	Viscous liquid	1.13
Barium liquid complex	Harshaw 1-V-7	Harshaw Chem. Co.	Liquid	1.010
Barium laurate	Ferro 180X	Ferro Chem. Corp.	Granular solid	1.21
" "	Harshaw 1-V-4	Harshaw Chem. Co.	Powder	1.44
Barium cadmium laurate	Mark XI	Argus Chem. Corp.	Powder	—
" " "	Advastab BC-12	Advance Solvents	Powder	—
" " "	Harshaw 12-V-5	Harshaw Chem. Co.	Powder	1.329
" " "	Ferro 1820	Ferro Chem. Corp.	Powder	—
" " "	Nuostabe V-30	Nuodex Prods. Co.	Powder	1.23
Modified barium cadmium laurate	Harshaw 128V5	Harshaw Chem. Co.	Powder	1.360
" " " "	Harshaw 281V4	" " "	Powder	—
Barium laurate/cadmium stearate	Ferro 416N	Ferro Chem. Corp.	Powder	—
Barium-cadmium soap	VS-31	Baker Castor Oil	Powder	—
" " "	Mark TT	Argus Chem. Corp.	Powder	—
" " "	Ferro 1840	Ferro Chem. Corp.	Powder	1.18
" " "	Synpron S-2	Syn. Prods. Co.	Powder	1.11
" " "	Synpron 140	" " "	Powder	1.1
" " "	Synpron 141	" " "	Powder	1.11
" " "	Synpron 32-B	" " "	Powder	1.15

(Continued on page 676)

Table 2 (Continued)

Chemical Name	Trade Name	Manufacturer	Physical Form	Density or Sp. Gr.
" " "	Synpron 340	" " "	Powder	1.05
" " " (modified)	Synpron 223	" " "	Powder	1.16
" " "	Witco #70	Witco Chem. Co.	Powder	1.23
" " "	Witco #71	" " "	Powder	—
Modified barium-cadmium soap	Clarite A	Natl. Lead Co.	Powder	1.34
Modified Clarite A	Provinite A	" " "	Powder	1.31
Barium-cadmium soaps & chelater	Ferro 1825	Ferro Chem. Corp.	Powder	—
Barium/cadmium mixed fatty acid esters	Stabelan HR	Harwick Std. Chem.	Powder	1.13
Chelated barium/cadmium soap (borate hydroperoxide)	Stabelan HR	Harwick Std. Chem.	Paste	1.15
Barium-cadmium soap of mixed fatty acid esters	Vanstay HT	R. T. Vanderbilt Co.	Powder	1.22
Barium 2-ethyl hexoate	Ferro 100	Ferro Chem. Corp.	Liquid	—
Barium/cadmium liquid complex	Mark M	Argus Chem. Corp.	Liquid	1.03
" " " "	Advastab BC105	Advance Solvents	Liquid	1.14
" " " "	Advastab X23-74	" "	Liquid	1.075
" " " "	Ferro 1203	Ferro Chem. Corp.	Liquid	1.06
" " " "	Ferro 1206	" " "	Liquid	1.16
" " " stabilizer	Barca 10	Deecy Prods. Co.	Dispersion	1.07
" " "	Vanstay R	R. T. Vanderbilt Co.	Liquid	0.99
" " "	Stabelan HR	Harwick Std. Chem.	Liquid	1.08
" " " dispersion	Witco 80	Witco Chem. Co.	Liquid	1.18

to ultra-violet light. It works rather well when compounded with lead stearate, lead silicate, or cadmium laurate. In order to minimize the toxicity hazard involved in mixing the dry compound into vinyl stocks, it is customary to use a paste, the average composition of which is seven parts stabilizer to one part plasticizer. Since this stabilizer is a pigment, it can be used only in opaque stocks.

Lead silicate, when prepared as a frit (powdered glass), is not a stabilizer for vinyl chloride and its copolymers. However, a precipitate made by double decomposition of solutions of lead acetate and sodium silicate is considered a good heat stabilizer, and gives a more transparent product than the other lead stabilizers. It also improves the power factor and insulation resistance of vinyl compounds. It is difficult to prepare because of the fineness of the precipitate, but the addition of a little barium acetate helps coagulate the suspension and improve filtration. Repeated washing of the precipitate improves the electrical properties of the stabilizer. Lead silicate is most readily incorporated in vinyl compounds when in the form of a dispersion in plasticizer, but this dispersion is subject to settling out.

Lead silicate-silica gel coprecipitates give transparency and less sulfur-staining than most of the lead stabilizers, and disperse more readily than ordinary lead silicate to give good heat and light stability. They are made in a wide range of lead contents having different refractive indices to suit the requirements of varying stocks. The closer the refractive index of the stabilizer is to the base, the more transparent is the resulting compound. The lead silicate-silica gel types are of particular value in highly colored cable masses where basic white lead carbonate has too high a pigmenting action and gives flat colors.

Basic white lead silicate, unlike the ordinary silicate, is opaque. It is a better heat stabilizer than the orthosilicate, and is a moderate light stabilizer. It is recommended for cable formulations.

Lead chlorosilicate seems to be more versatile than many of the other primary lead stabilizers used in vinyl electrical compounds. It is said to have an excellent balance of stabilizing performance, and the widest range of compatibility with electrical grade plasticizers. Other features of this type of stabilizer are its inherent moisture resistance, freedom from gassing, and only a moderate tendency to sulfur-stain. It has the lowest specific gravity of any of the primary lead stabilizers used in vinyl electrical work.

Tribasic lead sulfate is at present the only known sulfur salt of any commercial importance in the stabilizer field. It is a powerful acid acceptor, and has gained wide acceptance as a stabilizer for cable insulation and sheathing compounds. It has excellent electrical properties. Unlike basic lead carbonate, there is no danger of gas evolution upon overheating. As a white pigment, it offers some protection against ultra-violet light, but its pigmentation limits its use to opaque compounds. It should not be used with oil-type extenders, nor in the presence of phosphate plasticizers.

A basic lead silicate-sulfate complex finds use as a stabilizer for cable compounds, but is subject to yellowing in the presence of phosphate plasticizers.

Tribasic lead maleate, an unsaturated carboxylic acid, has a conjugated double-bond system which is capable of dienophilic activity by means of a Diels-Alder type reaction which the polyene formed by the thermal dehydrochlorination of PVC. This material combines the basicity and heat stabilizing action of the lead stabilizer with the dienophilic color-preserving action of maleic acid derivatives. It is one of the few really good all-around stabilizers based on lead.

Dibasic lead phthalate has good acid acceptance properties with some ultra-violet absorption. It is dispersed

readily in vinyl formulations, especially those made with phthalate esters. Its heat stability is diminished by the presence of phosphate plasticizers.

Lead salicylate is the most commonly used salicylate stabilizer for vinyls, with the possible exception of phenyl salicylate. It is a moderate heat stabilizer, but is best used in combination with a basic stabilizer such as basic lead phthalate or lead silicate-silica gel. Due to its high refractive index (1.78), it is not suitable for transparent stocks. Because it has little pigmenting power, it is useful for the production of brightly colored compounds. It gives satisfactory results with phosphate plasticizers and petroleum-type plasticizer-extenders, and is a good light-screening agent.

Dibasic lead phosphite is one of the best lead stabilizers, and is the most commonly used phosphorous stabilizer. It is a good acid acceptor, has mild antioxidant properties, ad is an excellent ultra-violet screener. It is opaque to visible light and suitable only for opaque vinyl stocks. It is capable of reaction with polyenes and, thus, inhibits color formation in heat-degraded PVC. It performs best in paste resins.

Dibutyl tin dilaurate is still one of the most widely used of the tin stabilizers, and will probably continue to be so because the patents covering it have lapsed. Its main applications are in the production of highly plasticized, crystal-clear extrusion and molding stocks, plastisols, and organosols. It has severe limitations in applications involving high temperatures, for which it has been largely superseded by the newer types of tin compounds. It is one of the few tin organics that gives good light stability.

The commercial material is deliberately manufactured from fatty acid containing other members of the series in addition to lauric in order to obtain a product that remains liquid under all normal conditions. The liquid is miscible with the common plasticizers and can be used for plastisols and spraying compositions without fear of the stabilizer settling out or causing gelation of plastisols, or flocculation of organosols. Unlike the soap stabilizers, it does not increase the viscosity of the plastisol. With regard to toxicological properties, the dose required to produce symptoms of poisoning is so large that there is virtually no danger of harmful effects resulting from the minute amount which could be extracted. However, precautions should be taken with the material in concentrated form because it is a skin irritant.

Dibutyl tin maleate is a much better color-inhibitor than dibutyl tin dilaurate for high-temperature processing owing to its dienophilic activity. It is slightly better in light stability, but does not have the clarity or compatibility of the laurate.

It is a polymeric material and difficult to manufacture to a controlled degree of polymerization. The low polymers are very volatile, and the fumes evolved from such processes as open-roll milling are dangerously vesicant. The high polymers, on the other hand, are less volatile but also less efficient as stabilizers. Unlike the laurate, the maleate is a solid and, because of its sticky resinous nature, more difficult to disperse in the vinyl premix. It is somewhat incompatible with vinyl compounds, and has a tendency to plate-out and stick to the calender rolls. The material has one very bad drawback in that it is very toxic and the dust is irritating to the mucous membrane. This product contains maleic acid, and all precautions recommended for maleic acid and maleic anhydride should be observed.

Physical mixtures of dibutyl tin dilaurate and dibutyl tin maleate are being used by some manufacturers who cannot employ laurate because of its short duration of heat stability and high temperatures. However, the mixture does not have the initial clarity of the laurate or the ultimate stability of the maleate.

One of the difficulties in preparing a practical organotin stabilizer is the problem of selecting an optimum alkyl-chain length. The long-chain fatty acids tend to give an incompatible product, while the short-chain types are too volatile and, because of their higher tin content, too expensive. One of the first polymeric compounds was anhydrobic-dibutyl polystannanediol dibutyl ester. By using a polymeric compound, high volatility is avoided and long-term stability improved. By using a relatively short alkyl chain, compatibility is kept comparatively high.

This stabilizer is soluble in hot plasticizers which aid its dispersion in the vinyl. Its cold solubility in ketones is useful in the preparation of organosols. It is fair in heat stability at high temperatures for moderate periods of time in plasticized stock, but less useful in unplasticized compounds. It has good light stability.

Thio-organo-tin compounds probably have the following composition: $R(SCO_2C_8H_{17})_2$. They provide exceptional heat stability and clarity at low concentrations, and good stability even in phosphate-plasticized systems. However, they have the following disadvantages which limit their use in the vinyl field: high cost; cross-staining with lead, cadmium, and copper; and the lower molecular weight mercaptides have a very disagreeable, pungent, persistent, skunk-like odor, poor light stability, and only fair lubricating qualities.

Antimony oxide is widely used as a fire retardant, and its use for this purpose is growing rapidly. Its bad features are it sulfur-stains badly, and it has poor light stability.

A tabulation of heavy metal soaps available commercially as vinyl stabilizers is given in Table 3.

Organic Stabilizers or Chelaters

The alkyl or aryl phosphites, such as triphenyl, tricresyl, tributyl, tri-2-ethylhexyl, and trioctyl, act as inhibitors to cloud formation due to metal chloride deposition from the action of soap stabilizers. They have been found also to improve heat and light stability. The mechanism by which these phosphites function is, in part, the formation of a metal complex, with the added phosphite retarding the formation of insoluble metal chloride. There are some disadvantages in their use, however, in that they are water-soluble and a vinyl compound containing them will increase in opacity when in contact with water or humid air. The organic phosphates are only fair in heat stability because of the high concentration of organic constituent in the molecule, while the inorganic salts are difficult to incorporate into the vinyl because of their poor dispersion properties.

Compounds of this type are generally referred to as chelaters, boosters, supporters, organic, or acceptors. The objective of these phosphites is not to be heat sta-

Table 3. Heavy Metal Soap Stabilizers

Chemical Name	Trade Name	Manufacturer	Physical Form	Density or Sp. Gr.
Zinc Compounds:				
Zinc stearate	—	Advance Solvents	Powder	1.095
" "	—	" "	Paste	—
" "	—	Argus Chem. Corp.	Powder	—
" "	—	Harshaw Chem. Co.	Powder	—
" "	—	Metasap Chem. Co.	Powder	1.095
" "	—	Syn. Prods. Co.	Powder	1.10
" "	—	Warwick Chem. Co.	Powder	—
" "	—	Witco Chem. Co.	Powder	—
Zinc laurate	—	Syn. Prods. Co.	Powder	1.09
Zinc-strontium laurate	Mark E	Argus Chem. Corp.	Powder	—
Zinc-barium laurate	Ferro 1907	Ferro Chem. Corp.	Powder	—
Zinc 2-ethyl hexoate type	Advastab ZN-9	Advance Solvents	Liquid	—
Zinc 2-ethyl hexonate complex type	Advastab X30-15	Advance Solvents	Liquid	1.10
" " " " "	Mark PL	Argus Chem. Corp.	Liquid	0.990
Zinc 2-ethyl hexonate complex type in alcohol plasticizer solution	Nuostabe V-51	Nuodex Prods. Co.	Liquid	—
Zinc 2-ethyl hexonate complex type in alcohol plasticizer solution	Ferro 700	Ferro Chem. Corp.	Liquid	—
Zinc 2-ethyl hexonate type	Nuostabe V-50	Nuodex Prods. Co.	Liquid	1.015
Zinc 2-ethyl hexonate alkyl/aryl phosphate	Harshaw 9-V-1	Harshaw Chem. Co.	Liquid	1.031
Cadmium Compounds:				
Cadmium stearate	—	Advance Solvents	Powder	1.214
" "	—	Ferro Chem. Corp.	Powder	—
" "	—	Mathe Chem. Co.	Powder	—
" "	—	Metasap Chem. Co.	Powder	—
" "	—	Syn. Prods. Co.	Powder	1.20
" "	—	Warwick Chem. Co.	—	—
" "	Stayrite #22	Witco Chem. Co.	Powder	1.21
Cadmium laurate	Harshaw 2-V-8	Harshaw Chem. Co.	Powder	2.44
" "	Nuostabe V-20	Nuodex Prods. Co.	Powder	1.2
Cadmium ricinoleate	—	Baker Castor Oil	Powder	1.11
" " in CCl_4	Staflex OY	Deecy Prods. Co.	Liquid	—
" " in DOP	Ferro 221	Ferro Chem. Corp.	Viscous liquid	1.12
" " in plasticizer	—	Deecy Prods. Co.	Liquid	—
Cadmium liquid	Stabilizer 89X	Advance Solvents	Liquid	—
Cadmium 2-ethyl hexonate	—	Argus Chem. Corp.	Liquid	1.08
" " " type	Nuostabe V-21	Nuodex Prods. Co.	Liquid	1.085
" " " "	Ferro 200	Ferro Chem. Corp.	Liquid	1.12
Cadmium/chelater type mixture	Mark XV	Argus Chem. Corp.	Liquid	1.07
" " " "	Ferro 203X	Ferro Chem. Corp.	Liquid	1.14
Cadmium alkyl phosphite complex	Harshaw 24VI	Harshaw Chem. Co.	Liquid	1.020
Cadmium alkyl-aryl phosphite	Harshaw 2-V-4	" " "	Liquid	1.08
Cadmium alkyl phosphite	Harshaw 2-V-7	" " "	Liquid	0.994
" " " (modified 2-V-4)	Harshaw 2-V-400	" " "	Liquid	1.053
Cadmium/chelate type mixture	Nuostabe V-22	Nuodex Prods. Co.	Liquid	—
" " " "	C-77	Advance Solvents	Liquid	1.057
Cadmium organic	Advastab VL-3	" "	Liquid	1.05
" "	Ferro 210	Ferro Chem. Corp.	Liquid	1.24
Cadmium napthanate 1,2-ethyl hexonate mixture	Ferro 211	Ferro Chem. Corp.	Liquid	1.06
Cadmium napthanate 1,2-ethyl hexonate mixture in plasticizer	JCX	Advance Solvents	Liquid	1.06
Cadmium powder modified with fatty acid	Synpron 201R	Syn. Prods. Co.	Powder	—
Cadmium powder modified with barium	Synpron 202R	" " "	Powder	—
Lead Compounds:				
Lead stearate	—	Advance Solvents	Powder	1.35
" "	—	" "	Powder	1.41
" "	—	Harshaw Chem. Co.	—	—
" "	—	Metasap Chem. Co.	Powder	1.323
" "	Leadstar	Natl. Lead Co.	Powder	1.40

Chemical Name	Trade Name	Manufacturer	Physical Form	Density or Sp. Gr.
" "	Nuostabe V-2	Nuodex Prods. Co.	Powder	1.4
" "	—	Syn. Prods. Co.	Powder	1.35
" "	Stayrite #10	Witco Chem. Co.	Powder	1.37
Dibasic lead stearate	—	Advance Solvents	Powder	2.02
" " "	DS-207	Natl. Lead Co.	Powder	2.02
" " "	Nuostabe V-1	Nuodex Prods. Co.	Powder	2.0
" " "	Stayrite #15	Witco Chem. Co.	Powder	1.91
Lead 2-ethyl hexoate	Ferro 301	Ferro Chem. Corp.	Dry solid	—
Basic lead carbonate	—	Natl. Lead Co.	Powder	6.7
Basic lead organic complex	Stayrite 229	Witco Chem. Co.	Powder	5.9
Lead organic silicate	Ferro 361	Ferro Chem. Corp.	—	—
Basic white lead silicate	BWIS 201	Eagle-Picher Co.	Powder	4.5
" " " " in 5% mineral oil	BWIS 202	" " "	Paste	5.1
Lead chlorosilicate complex	Lectro #60	Natl. Lead Co.	Powder	4.0
Lead silicate-silica gel co-precipitate	Plumb-O-Sil A	Natl. Lead Co.	Powder	4.1
" " " " "	Plumb-O-Sil B	" " "	Powder	3.3
" " " " "	Plumb-O-Sil C	" " "	Powder	2.96
Tribasic lead sulfate	Tribase	" " "	Powder	7.1
Basic lead silicate-sulfate complex	Tribase E	" " "	Powder	5.55
Tribasic lead maleate	Trimal	" " "	Powder	6.0
Dibasic lead phthalate	Dythal	" " "	Powder	4.6
Lead salicylate	Normasal	" " "	Powder	2.36
Dibasic lead phosphite	Dyphos	" " "	Crystals	6.94
Tin Compounds:				
Dibutyl tin dilaurate	D-22	Carbide & Carbon	Liquid	1.06
" " "	Thermolite 12	Metal & Thermit	Liquid	1.05
Dibutyl tin maleate	Thermolite 13	" "	Solid	1.4
Dibutyl tin laurate/maleate mixture	Ferro 823	Ferro Chemical Corp.	Liquid	1.15
" " " "	Advastab PX1835	Advance Solvents	—	—
" " " "	Thermolite 17	Metal & Thermit	Liquid	1.15
Polymeric organo-tin	Stabilizer 3	Advance Solvents	Powder & Liquid	—
Thio-organic-tin compound	Stabilizer 17M	Advance Solvents	Liquid	1.12
" " " "	Mark X	Argus Chemical Corp.	Liquid	—
" " " "	Ferro 840	Ferro Chem. Corp.	Liquid	1.11
" " " "	Thermolite 20	Metal & Thermit	Liquid	0.995
" " " "	Thermolite 31	" "	Liquid	1.11
" " " "	Nuostabe V-80	Nuodex Prods. Co.	Liquid	1.15
" " " "	Nuostabe V-81	" " "	Liquid	1.12
Organic tin compound	Thermolite 99	Metal & Thermit	Liquid	—
" " "	Stabilizer 52	Advance Solvents	Liquid	1.00
" " " (concentrated version of 52)	52-16	" "	Liquid	—
Organic tin salt	OM-10	" "	Liquid	1.02
" " " (concentrated version of OM-10)	OM-18	" "	Liquid	—
Organo-tin compound	Advastab T-72	" "	Liquid	1.19
" " "	Advastab 50L2	" "	Liquid	1.32
Tributyl tin oxide	Thermolite 15	Metal & Thermit	—	—
Stannous-cadmium type	Synpron 93	Syn. Prods. Co.	Powder	1.1
" " "	Synpron 95	" " "	Powder	1.1
Stannous-zinc-cadmium type	Synpron 231	" " "	Powder	1.18
" " " "	Synpron 250	" " "	Powder	1.11
Antimony Compounds:				
Antimony oxide	—	Harshaw Chem. Co.	Powder	—
" "	—	Metal & Thermit	Powder	—

bilizers but to act as boosters to minimize color development by deactivating the chloride degradation product formed when the plastic is subjected to extreme heat or direct ultra-violet light. For example, a stabilizer may offer fair initial clarity and good heat stability to a stock at 350° F. for only a short time, decomposing rapidly under prolonged high temperatures. With the addition of a chelating agent, the initial clarity is improved considerably with good initial color, and the length of time in which heat stability is maintained is also improved to a considerably greater extent.

Certain of these compounds also act as antioxidants in repressing the formation of color-bearing fragments which normally result from heat degradation. Other functions of these chelaters are preventing embrittlement and loss of film strength, reduction of plating-out on calender rolls, and improvement in heat-sealability.

Organic phosphites of this type generally are most effective with barium-cadmium mixtures, and with cadmium, zinc, lead, and strontium soaps.

Table 4. Chelater-Type Stabilizers

Chemical Name	Trade Name	Manufacturer	Physical Form	Density or Sp. Gr.
Phosphite type	CH-14	Advance Solvents	Liquid	1.09
" "	CH-20	" "	Liquid	1.07
" "	Clarite B	Natl. Lead Co.	Liquid	0.930
" "	Provinite B	" " "	Liquid	0.992
Aryl phosphite	Mark XX	Argus Chem. Corp.	Liquid	1.07
Aryl phosphite type	Ferro 903	Ferro Chem. Corp.	Liquid	—
" " "	Ferro 906	" " "	Liquid	0.979
Alkyl-aryl phosphate complex	Harshaw 8-V-1	Harshaw Chem. Co.	Liquid	0.994
" " " " (modified 8-V-1)	8-V-100	" " "	Liquid	0.957
Alkyl phosphite type	Harshaw 8-V-5	Harshaw Chem. Co.	Liquid	1.001
" " "	Nuostabe V-40	Nuodex Prods. Co.	Liquid	0.965
Organic borate, phosphite, and phenolic mixture type	Vanstay S	R. T. Vanderbilt Co.	Liquid	1.03
Organic phosphite type	Stayrite 75	Witco Chem. Co.	Liquid	—
" " "	Stayrite 76	" " "	Liquid	—
" " "	Nuostabe V-42	Nuodex Prods. Co.	Liquid	1.120
" " "	Nuostabe V-43	" " "	Liquid	1.075
" " "	Nuostabe V-44	" " "	Liquid	1.058
" " "	Nuostabe V-45	" " "	Liquid	1.020
Organic alkyl phosphite type	Synpron 450	Syn. Prods. Co.	Liquid	0.89
" " " "	Synpron 451	" " "	Liquid	0.90
" " " "	Synpron 452	" " "	Liquid	0.95
Organic aryl phosphite type	Synpron 461	" " "	Liquid	1.07
" " " "	Synpron 462	" " "	Liquid	1.13
Phenyl salicylate (salol)	—	Dow Chemical Co.	Powder	—
" " "	—	Heyden Chem. Co.	Powder	—
" " "	—	Merck & Co.	Powder	—
" " "	—	Monsanto Chem. Co.	Powder	—
Non-metallic organic	E-49	Advance Solvents	Liquid	1.029
" "	Advastab E6B	" "	Viscous liquid	1.08

Table 5. Epoxide Stabilizers

Chemical Name	Trade Name	Manufacturer	Physical Form	Density or Sp. Gr.
Epoxy type	Alk-O-Flex 453	Alkydol Prods. Co.	Liquid	—
" "	Araldite 6020	Ciba Co.	Liquid	—
" "	Araldite 6040	" "	Liquid	—
Epoxy resin	ERL-2795	Carbide & Carbon	Liquid	1.12
" "	ERL-3794	" "	Viscous liquid	1.2
" "	ERL-2774	" "	Viscous liquid	1.15
Modified Epon 834 epoxy resin	Ferro 900	Ferro Chem. Corp.	Viscous liquid	1.14
100% epoxy resin (equivalent to Epon 834)	Ferro 909	" " "	Viscous liquid	1.17
100% epoxy resin (equivalent to Epon 1064)	Ferro 920	" " "	Solid	1.14
50% Epon 1064 in high-boiling solvent	Ferro 931	" " "	Liquid	1.06
Modified 100% active epoxy	Harshaw 7-V-1	Harshaw Chem. Co.	Liquid	1.071
" " " "	Harshaw 7-V-2	" " "	Liquid	1.110
" " " "	Harshaw 7-V-4	" " "	Liquid	1.160
Epoxide-ether condensation polmer.	Epon 828	Shell Chem. Corp.	Viscous liquid.	1.1676
" " " "	Epon 834	" " "	High-viscosity liquid	1.1648
" " " "	Epon 864	" " "	Semi-solid	1.188
Epoxy-organic type	Synpron 470	Syn. Prods. Co.	—	1.01
" " "	Synpron 472	" " "	—	1.01
" " "	Advastab E-82	Advance Solvents.	Viscous liquid	1.060-1.070

Chemical Name	Trade Name	Manufacturer	Physical Form	Density or Sp. Gr
Epoxidized oils	Advastab PS-38	Advance Solvents	Liquid	1.02
" "	Admex 710	Archer Dan. Midland	Liquid	0.9903
" "	Admex 711	" " "	Liquid	0.998
" "	PX-800 Epoxy	Pitts.Coke & Chem.	Liquid	0.992
" "	Paraplex G-60	Rohm & Haas Co.	Liquid	0.993
" "	Paraplex G-61	" " "	Liquid	0.995
" "	Paraplex G-62	" " "	Liquid	0.999
" "	Plasticizer ES	Rubber Corp. of Amer.	Liquid	—
Epoxy Stearate P				
Octyl epoxy stearate	Drapex 3.2	Argus Chem. Corp.	Liquid	0.89
" " "	Admex 744	Archer Dan. Midland	Liquid	0.909
Isobutyl epoxy acetoxy stearate	Estynox 366	Baker Castor Oil	Liquid	0.964
Butyl epoxy stearate	Estynox 403	" " "	Liquid	0.924
" " "	KP-90	Ohio Apex	Liquid	0.912
Hexyl epoxy stearate (?)	Monoplex S-71	Rohm & Haas Co.	Liquid	0.901
Modified Monoplex S-71	Monoplex AG-28	" " "	Liquid	—
Epoxy acetoxy stearin	Estynox 308	Baker Castor Oil	Liquid	1.01

The salicylate group has the useful property of being opaque to ultra-violet light and transparent to visible light. This permits the use of salicylates as ultra-violet filters in transparent compounds, thus inhibiting the catalytic oxidative decomposition of vinyl polymers. The alkaline earth salts of nuclear-substituted salicylic acid (e.g., barium di-isopropyl salicylate) have the advantage of being plasticizer-soluble. Magnesium, strontium, calcium, and stannous salicylates are good heat stabilizers, particularly for long-term moderate temperature conditions, in addition to their ultra-violet barrier properties. The organic salicylates, such as phenyl salicylates (salol), have been used as light stabilizers and have no value as heat stabilizers.

Commercially available chelaters are tabulated in Table 4.

Epoxide Stabilizers

There are four types of epoxy stabilizers being offered on the market today, as follows: (1) epoxide-ether condensation polymers; (2) epoxy esters which are epoxidized unsaturated fatty acid esters; (3) epoxide plasticizers, consisting of mixtures of epoxide plasticizer with a conventional metal soap or chelater; and (4) epoxide soaps. Commercial epoxide stabilizers are listed in Table 5.

Epoxy ether condensation polymers are available in a range of molecular weights, and in both solid and liquid forms. High molecular weights are preferable, since the lower weights are toxic and cause dermatitis. They are readily compatible with vinyl in concentrations up to 5% of the total plasticizer, and are transparent and dark yellow in color.

Since they are good acid acceptors but poor color inhibitors, the polymers are not used by themselves but always with a good heat stabilizer. They also contribute to good light stability. They are soluble in the common ester-type plasticizers.

As previously mentioned, the epoxide resins are not particularly good stabilizers when used alone because of inadequate color-inhibiting properties, but they do produce powerful synergistic combinations. Among the stabilizers whose action is synergized by epoxide are the metallic soaps, such as those made with zinc, cadmium, barium, strontium, and lead. The epoxy material also is effective when chlorinated paraffins or phosphate plasticizers are present.

Unsaturated fatty acids can be epoxidized across their double bonds by means of aliphatic per-acids. In this way, the cheap, naturally-occurring fatty acid esters, such as soybean oil, can be converted into compatible plasticizers.

The epoxy esters generally are used at a concentration of 3-10 parts per 100 parts resin as a partial replacement for an equivalent amount of primary plasticizer. Their use generally results in a marked improvement in the heat and light stability of the plastic material. This frequently can result in permitting a decrease in the amount of costly metallic stabilizer and, thus, more than offset the slight additional cost of the epoxy esters over primary plasticizers. The stabilization effects of these esters are particularly evident when blended with such plasticizers as phosphates, chlorinated paraffins, and glycol esters.

There are two types of epoxy esters; the epoxidized oils, such as soybean oil, which give excellent stabilization; and the epoxy stearate type which gives good stabilization with excellent low temperature flexibility.

Mixtures of epoxide plasticizers with conventional metal soaps and chelaters have been developed recently.

Epoxy metal salts may be either inorganic or organic in nature. Unsaturated fatty acids containing 10-20 carbon atoms have been developed by adding the epoxy to the fatty acid salt. Thus, the stabilizing effect is said to be improved considerably, opening a new field for soap stabilizers.

Acknowledgments

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(*Continued on page 684*)

Leland E. Child, Monsanto

Styrene Container–Lid Design

Recommended designs for plastic containers and lids are given to assure proper fits and adequate service.

BENNETT NATHANSON, *Technical Service Representative, Plastics Division, Monsanto Chemical Co., Springfield, Mass.*

The molded polystyrene application which has experienced the greatest growth within the past year is that of stock containers. Packages or containers from 2-24 ounces in capacity are currently used for products ranging from foods to hardware. Two well-defined markets have developed for these polystyrene containers.

The first market is for rigid, crystal clear, quality-grade containers having a minimum wall thickness of 0.035 inch. These containers are sold on the bases of durability as compared to glass, and transparency as compared to paper. Their principal function is to boost point-of-sale impulse buying, and spotlight premium cost items. The main demand for such containers is in the larger than eight-ounce capacity sizes.

The second market and growth area for styrene is in the thin-walled container field ranging from 0.015-0.025 inch in thickness. These containers compete primarily with resin- or wax-coated papers.

Both of these market applications present specific design problems which must be solved in order to fully develop the potential markets. Material characteristics, end-use requirements, sidewall thickness, and the design of lip, lid, bottom, and bottom fillet are all points which must be considered carefully to properly carry out a design program for styrene containers.

Within recent months, the introduction of high-speed injection molding machines has changed many concepts of part and mold design. Due to the natural desire by molders for economical production, machine cycle times have been reduced to the extreme minimum, requiring exacting performance standards for both machines and materials. Since the reduction of the operational cycle may tend to induce strains in the molded part, product design based on maximum material flow has assumed vital importance.

Container Design

In the design of a typical styrene container or vial, four distinct problem areas are encountered. The container outlined in Figure 1 illustrates these four areas.

The styrene is injected into the mold through the gate at the bottom and fills the bottom of the cavity. The material is hottest at this point, and has its lowest viscosity. Following the bottom fill, the next problem area is encountered as the material starts to flow around the corners. The sharp turn at the junction of the bottom surface and the sidewall restricts the flowing material, and high pressures are needed to push the material along its course. The restriction at the corners induces strains, and stress concentration may be high.

The third problem area is at the sidewalls. As the material moves further from the gate it becomes cooler and the viscosity becomes higher, necessitating still greater pressure to keep the material flowing. The fourth problem area is at the lip, which in Figure 1, causes a constriction of the material flow. If the material is too cold or stiff when the lip fill is completed, residual strain is high and the lip section may have little stress resistance.

Maximum flow and minimum stress are favored by

container designs similar to that shown in Figure 2. Since the material is hottest at the gate, the bottom of the container has the thinnest wall. A curvature or bow, designed as a part of the bottom, would add strength to the container. The bottom section increases in thickness as it approaches the side wall.

Square corners at the container bottoms are points at which stress concentrations may develop. Designs which minimize this stress and facilitate material flow will have rounded corners with a radius of 3/8-5/8 inch, as shown in Figure 2.

The sidewall is thickened gradually from the radius in the bottom corner to the lip at the top of the container. An increase of 0.001-inch per inch should be made in the wall section thickness starting from the bottom and proceeding to the top edge of the container.

The bead in the rim of the container should be approximately 1½-2 times the thickness of the container sidewall, and the width should approximate the preceding wall thickness. The thicker section allows easier flow of the material which has reached its highest viscosity at this point. An added design feature of the thickened rim is that it should be as flat as possible on the top surface. Flatness and the thicker beaded section increases the amount of surface area available to absorb the shock created by the mold stripper plate. Designs which embody a sharp, radiused topside or a thin rounded bead may crack or craze in molding.

A "dimple" located on the bottom of the container is suggested for production ease and increased quality. With thin-walled bottoms, the small pin-point gate sets up rapidly while the bottom itself is still warm. As the die opens and the core plates are separated from the cavity, there may be a tendency for the gate to "pull" the bottom slightly. The dimple allows the gate to be separated and any sinkmarks, if they occur, to be in the dimple rather than at the bottom. The suggested size for the dimple would be 3/8-7/16 inch in diameter and a thickness of twice the bottom thickness.

In the accompanying diagrams, dimensional increases in wall section thickness are based on the principle of allowing the coolest material to enter the thickest cross sections.

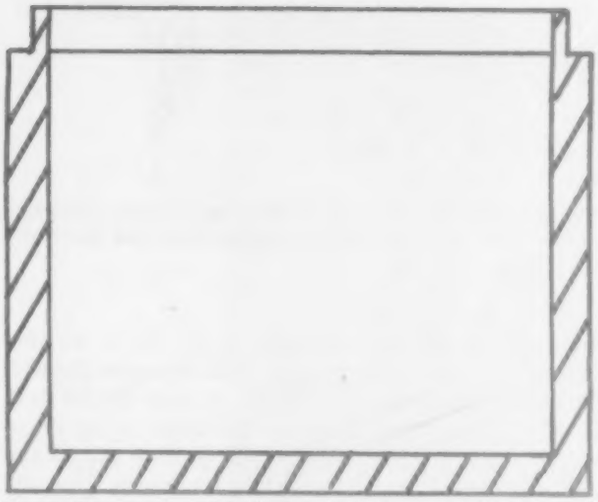

Fig. 1. Cross-section of typical molded styrene container or vial.

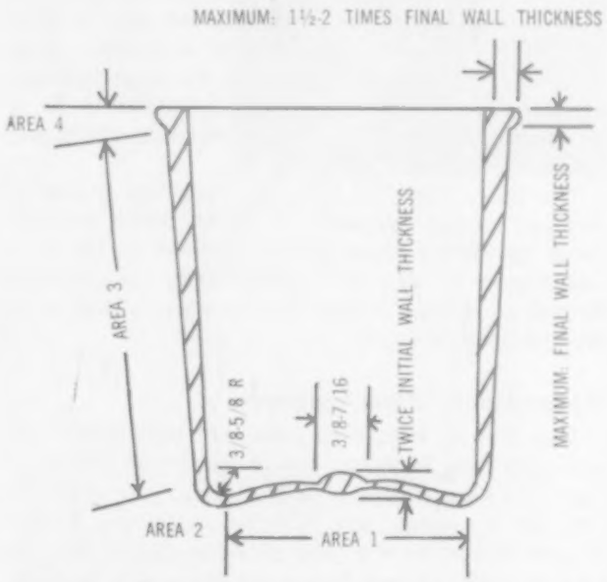

Fig. 2. Cross-section of container design favoring maximum styrene flow and minimum stress.

Lid Design

Little consideration was given to the function of a container lid when the first styrene containers and lids were designed. Experience, predetermined performance requirements, and ingenuity of the molder-designer has developed a range of designs.

The successful design will (1) achieve a tight container-to-lid fit to avoid spoilage and loss of product; (2) allow the lid to brace the container lip against extreme flexing due to handling; and (3) allow ease of lid-to-container assembly by either hand or automatic machine.

While we are concerned essentially with round containers, the following design principles will also apply to rectangular-shaped containers.

In designing the lids for styrene containers, rigidity should be imparted to both container and lid.

Three types of styrene lid-to-styrene container fit combinations are illustrated in Figure 3. Type I is that

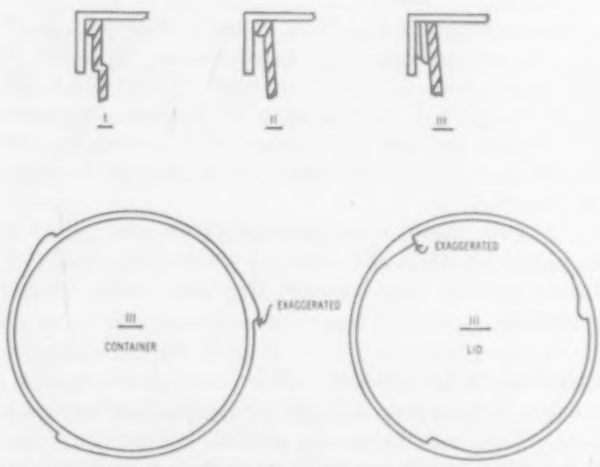

Fig. 3. Typical styrene container-to-styrene lid fit designs: I—Slip fit; II—Beaded rim; and III—Screw type. Expanded views of container and lid for screw-type (III) show positioning of lugs.

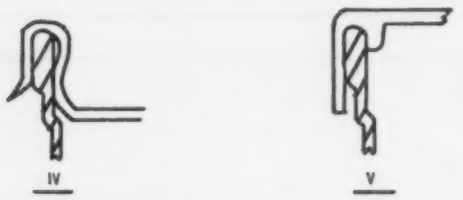

Fig. 4. Current fit designs for styrene lids on paper containers: IV—lid fabricated from biaxially-oriented sheet; and V—Molded lid.

Fig. 5. Fit designs for polyethylene lids on styrene containers: VI—Rim-edge seal; and VII A and VII B—Snap-fit edge seals.

which has no ridge or ring around the rim of the container. This assembly is a slip fit, with the inside diameter of the lid having a slight undercut to allow the lid to fit closely to the outside container diameter. A slip fit assembly requires close fit tolerances on both the lid and container, since too tight a fit may cause container breakage and too loose a fit may cause loss of the package's contents.

Type II has a beaded rim approximately twice the wall thickness of the container. The lid may be fitted tightly over the ring, which acts as a structural reinforcement. The added thickness of the ridge increases its stressbearing properties. The lid-container fit is designed within the tensile elongation limits of the material to provide a secure lock.

The lid in Type III has screw-type lugs placed at intervals around the inside of the lid, while the container has similar screw-type lugs around the rim bead (see Figure 3). The lid is locked onto the container through a twisting action. The number of lugs used may be three or more.

Styrene Lids for Paper Containers

Thus far, we have been concerned with plastic lids and containers. However, one of the newest and more important uses of plastics in packaging is in clear styrene lids for stock sizes of paper containers. Recent statutes enacted by a number of states specify that lids for food packages must have a rim that covers the outer diameter of the container. The simplicity by which such a design may be molded in styrene, plus the feature of "see-through clarity," are major factors in favor of styrene lids.

Design types IV and V in Figure 4 illustrate two of the current styrene-paper combinations. Type IV is fabricated from a biaxially-oriented styrene sheet. Biaxial orientation imparts unusual strength characteristics to the sheeting. As a consequence, it may be used in gauges of 0.010 inch, and may be formed for snap-fit assembly.

The next design is for molded styrene lids (Type V in Figure 4). Here, the outer lid rim and the inner ring firmly position the lid over the upper edge of the container.

Polyethylene Lid Design

When snap-on or tight-fit lid designs are required, polyethylene may be used in place of styrene. The combination of a rigid styrene container and flexible polyethylene lid has been used for a number of "premium" packages. Types VI, VII A, and VII B in Figure 5 illustrate polyethylene lid designs. Type VI is a tight rim-edge seal, while Types VII A and VII B are snap-fit edge seals.

Conclusions

Package designs have been and will be modified for the purpose of packaging specific items, and to suit the requirements of automatic loading equipment. As mold designers and material manufacturers become more familiar with these special requirements, new materials and designs will be developed. A continued study of consumer packaging and marketing trends becomes mandatory for the plastics industry if it is to maintain its competitive position and fully develop the potential market for its products.

—THE END

Stabilizers for Vinyl Chloride and Its Copolymers—Part II.
(*Continued from page 681*)

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—THE END

Guest Editorial

Use of "Value Analysis" in the Plastics Molding Industry

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Back in 1894, General Electric bought the formula and some equipment from a Brooklyn pencil manufacturer to mold pencil "lead" from a compound of clay and carbon. The molded product was first used to improve arc lamp carbons. Before the turn of the century, molding techniques were applied by G-E to shellac, mica, hard rubber, cumar, and other natural resins to provide insulating parts for electrical apparatus.

Plastics and electrical apparatus were "futures" that proved to be interdependent. Plastics molding was expanded year by year to satisfy our own needs. Soon, it became possible to accommodate increasing numbers of outside customers with our custom molding service.

All this, of course, is an indirect way of saying that we at General Electric have enjoyed over 60 years of plastics experience. But as you might well imagine, due to the developing nature of the plastics field we are constantly adapting and learning as we continue our service in the industry. As you may remember, the first separate G-E plastics plant was established in 1929, and in 1932 the Plastics Department became an autonomous organization within our company.

We fully recognize the highly competitive nature of the plastics molding industry, and have felt that our chief contributions to customers must include expert engineering assistance and prompt service. We have developed first-class engineering units at both our eastern facility in Taunton, Mass., and our midwestern plant at Decatur, Illinois. At these two locations, we have built facilities for fabrication of all major types of molded plastic parts.

The strongest benefit we can give to customers must undoubtedly be in terms of what we call "Value Analysis". By this concept, we mean a creative study of every item of cost in every part or material, and considering other materials, newer processes, abilities of specialized suppliers, and possibilties for engineering re-evaluation. It focuses engineering, manufacturing, and purchasing attention on one objective: the same performance at lower cost. It actually supplements the good, normal cost reduction activities of our organization.

Now, in this quickly-changing economy of ours, it is imperative that we select the best machines, materials, and processes now being developed in serving our customers. By choosing the proper combination of such elements, we are able to provide our customers with a high production rate at low-unit cost, while maintaining product quality. Thereby, we enable them to better meet competition in their own industries.

Thoroughly trained in "Value Analysis" techniques, our marketing and engineering people constantly seek to

(Continued on page 689)

Charting Production Schedules

The use of charts for planning molding production schedules, and for indicating current production operations to management.

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The plastics production executive is faced with the responsibility of maintaining a systematic production schedule for all the presses in the plant. Maximum output from both the molds and the presses must be maintained because of the high initial investment involved. Capacities of presses in the average molding plant vary considerably (see Figure 1). Similarly, the sizes of production molds differ in accordance with the respective volume requirements. As a result of these wide variations in the instruments of plastic molding production, it becomes a very complicated problem at times to gear manufacturing facilities to the constant flow of incoming orders.

During normal times, a certain percentage of plastic molding equipment is idle. This is especially true with regard to the compression molding presses. Consequently, reasonable delivery promises can be given to customers as a general rule. At peak periods, however, the plant manager has to do his utmost to coordinate incoming orders with available press capacity.

Without the use of an accurate and efficient scheduling system, the plant manager will be faced not only with the task of explaining many broken delivery promises, but also the possible loss of valuable business. Because of the many variables existing in a plastic molding plant, some kind of efficient system has to be put into effect. The variables occur in the sizes of the presses, dimensions of the molds, land areas of the dies, and the productive capacities of the molds.

The Production Schedule Chart

In scheduling compression press operations, the molding plant engineer is vitally interested in two things: (1) the capacity of the press; and (2) the size of the die. From the press capacity he can determine the maximum allowable mold size for installation in that press; and from the size of the mold he can ascertain

Photo courtesy Chicago Molded Products Corp.

Fig. 1 Molding room of a large plant containing about 100 compression and transfer presses ranging in capacity from 15-750 tons.

the rate of production for any particular length of time.

Each press should be card indexed so as to provide important details pertaining to the machine. Information such as the number of the press, its capacity in tons, ram travel, amount of vertical space (daylight), maximum allowable mold dimensions, type of press, and all other pertinent operating details, must appear on each card.

Similarly, a card index has to be made as a record for each mold in the plant. Even more information usually appears on these cards because they represent the entire story on the articles produced from the dies. In general, the following data is included on a die index card:

(1) Name and number of the product.
(2) Number of the die.
(3) Net weight of the piece.
(4) Gross weight of the material.
(5) Number of cavities in the mold.
(6) Overall dimensions of die.
(7) Cycle time required.
(8) Are preforms or powder being used.
(9) Press tonnage required.
(10) Mold construction date.

With this information recorded, reference can now be made to the production schedule chart shown in Figure 2. This schedule represents a practical method of plotting a production course.

It will be noted that the first two columns of the chart are used to designate the press number and tonnage. This information serves to coordinate the production date with that of the press card. Furthermore, it discloses at a glance which molds can be placed in each press.

In the third column the name and number of the specific item is recorded, while in the next two columns the customer's name and his order number are listed. Column six indicates the total number of parts required for the order; this figure being the starting point for all production calculations.

The date on which actual molding starts is shown in column seven, and the estimated daily production appears in column eight. Estimates of daily production are based, of course, either on past experience or on expected cycle time multiplied by the number of cavities in the mold. In the case of long runs, allowance for down-time is made before an entry in the daily production column is made.

The remainder of the production schedule sheet is devoted to spaces which represent the passage of time charted as weeks. Calendar dates can be filled in to indicate the last day of each successive week. This sheet may be continued in a horizontal direction in instances where production information more than six weeks in advance is desired.

PRODUCTION SCHEDULE

Description								Year ------ Week Ending					
Press No.	No. Tons	Article	Customer	Order No.	Quan.	Date Start.	Daily Prod.						

Fig. 2 Typical chart for scheduling molding production.

Using the Chart

On the chart shown in Figure 3, many hypothetical entries have been made in order to illustrate how the actual scheduling operates. In this case only seven presses are listed, but in actual practice any number of machines may be utilized, and the records kept by either extending the sheet or adding more sheets. In this respect it should be noted that addition of the figures appearing in column six will give an immediate check on the total quantity of parts on order. Comparisons then can be made with preceding months to show the general production trend. These data are of particular importance to the sales department.

A further look at the filled-in chart in Figure 3 will disclose four different press sizes, starting with the 50-ton unit and going up to the 200-ton capacity. Work for these presses is not selected arbitrarily, but rather on the basis of pressure requirements for the various molds. A decision as to which presses are to be used should be arrived at only after careful study of the die cards. Overall dimensions of the molds and the total amount of land areas of the respective cavities must be ascertained before any press selection is made.

Returning to the hypothetical schedule shown in Figure 3, a look at the first item on the list indicates that the 0154 Mast, Order No. 1039, for the customer, C. W. Barret, calls for 20,000 pieces. Production on this order started on September 5, and the daily quantities to be made amount to 2,000 units. Consequently, on a five-day week it should take just two weeks to complete the order. This is shown graphically under the "Week Ending" schedule.

Apparently, the production department has scheduled a comparatively short run next on the H-55 Housing for M. Dickson. Only 5,000 pieces are needed of this part and, on the basis of producing 1,000 pieces a day, the order should be completed in one week. This is shown graphically by the solid line under the September 24 column.

On the next item, which is listed as the C-84 Rotor, the total order for H. Sorenson is relatively large. With a daily production of 5,000 units, it will take approximately five weeks to complete the order. Hence, the scheduling of this part will have to be carried over onto another record sheet. In actual practice, this duplication of work can be obviated by the use of much longer sheets that will accommodate more than six weeks of elapsed time. Sheets of twice the length shown will permit the extension of a production schedule as far ahead as three months.

It will be noted that the abbreviation "Propriet" appears in some instances. This refers to the so-called proprietary items which are made to go into stock, rather than directly to the customer. The quantity required to replenish stock is so designated in the "Order No." column. The time necessary for fulfillment of the stock order is carried along in the standard manner. This type of procedure is exemplified on the chart by the B-12 Handle and the B-13 Base.

PRODUCTION SCHEDULE

DESCRIPTION								YEAR 1955 WEEK ENDING					
Press No.	No. Tons	Article	Customer	Order No.	Quan.	Date Start.	Daily Prod.	Sept. 10	Sept. 17	Sept. 24	Oct. 1	Oct. 8	Oct 15
1	50	0154 Mast	C.W. Barret	1039	20M	9/5	2,000	—	—				
		H55 Housing	M. Dickson	1056	5M		1,000			—			
		C-84 Rotor	H. Sorenson	1142	120M		5,000				—	—	—
2	200	9168 Cap	Reo Mfg. Co.	1283	500M	9/8	10,000	—	—	—	—	—	—
3	150	C 14 Plug	O.W. Parker	1040	60M	9/5	3,000	—	—	—	—		
		G-62 Slide	C. M. Ryan	964	50M		5,000					—	—
4	150	P-12 Handle	Propriet.	Stock	60M	9/29	4,000	—	—	—			
		P-13 Base	Propriet.	Stock	60M		4,000				—	—	—
5	100	0-29 Box	Lee Corp.	1102	10M	9/5	1,000	—	—				
		0-47 Cap	B. & E. Co.	1042	150M		5,000			—	—	—	—
6	200	P-29 Toggle	Propriet.	Stock	100M	9/22	5,000	—	—				
		B-30 Loop	Monroe Mfg.	982	24M		2,000			—	—	—	
7	100	0131 Ring	M. Nickson	1057	25M	9/5	1,000	—	—	—	—	—	
		C185 Button	Arts Inc.	1264	200M		5,000						—

Fig. 3. Scheduling chart in operation showing hypothetical entries.

During the average business week many conditions affecting production schedules are likely to arise, and decisions must be made in order to cope with the changes that occur. For instance, a customer such as Lee Corporation, shown opposite Press No. 5, may send in a request for an additional 10,000 pieces of the O-29 Box just at the time that the original order nears completion. According to the schedule, arrangements have been made to remove this die at the end of two weeks and the press scheduled to run for four weeks on the O-47 Cap for the B. & E. Co.

To dismantle and install dies is an expensive and non-productive operation, and the efficient manager attempts to keep this overhead cost down to a minimum. Therefore, in this case the most economical procedure would be to continue production on the O-29 Box. This extended production or over-run would mean, however, that the delivery date on the O-47 Cap would have to be advanced in two weeks.

A problem such as this is much more easily solved when a chart shows the situation at a glance. Fulfillment of delivery promises is of constant concern to the production manager, but the use of a chart serves to ease this worry to a large degree. The sales department, as well as the production planners, can scan the graphic schedule in order to arrive at a decision.

The graphic schedule not only makes it easier for management to keep promises, but also permits those in charge to make production adjustments when necessary. If, for example, Arts Incorporated made a special appeal for better delivery than October 15 on its 0185 Button, this request could be considered from a graphical standpoint. In view of the fact that the die for this item can be placed in Press Nos. 5 or 7, consideration can be given to running the order ahead of the 0131 Ring for M. Nickson. This particular order could also be scheduled before running the O-29 Box for the Lee Corporation. Although the production schedule is prepared with a fixed purpose in mind, a certain amount of flexibility is possible in instances where exigencies arise.

Charting Injection Molding

The general outline of the production schedule shown in Figure 1 is made expressly for compression molding operations. However, injection molding production can be scheduled in the same manner. The only variation in use of the chart would be in the heading for Column 2. Instead of recording the number of tons, the capacity of the machine in ounces can be substituted.

Of course, the "Daily Production" column will contain much higher figures because of the much greater speed of production by injection molding. Also there will be shorter runs, more die changing, and larger production quantities entailed. As a result, the lines appearing in the "Week Ending" sections will be broken off within the week, and new ones started in the middle of a week. If necessary, the spaces representing weeks can be further subdivided into seven divisions to designate the actual days in the week.

Conclusions

Because of the many variables existing in plastic molding plants, some type of efficient system for planning production has to be put into effect. These variables are to be found in the sizes of the presses, dimensions of the molds, land areas of the dies, and productive capacity of the molds. Without a well-planned production schedule, any semblance of operational efficiency will be absent.

Charts, such as the ones illustrated and discussed, permit the sales department to see exactly what to expect in the way of deliveries. A graphic production schedule also serves as a guide to the sales manager who wishes to plan his future sales activities. Of greatest importance, however, is the fact that such a chart gives the production department finger-tip information pertaining to molding operations throughout the entire plant.

—THE END

Use of "Value Analysis" in the Plastics Molding Industry
(*Continued from page 685*)

discover the right answer to the following five questions concerning a product: (1) What is it?; (2) What does it cost?; (3) What does it do?; (4) What else could do the job?; and (5) What would that cost?

Such an approach is essential if we are to properly meet conditions created by shifting markets, and if we are to make a genuine contribution to our customers. Earlier this year, a trade publication survey developed the fact that 78% of design engineers in industry considered cost reduction as their top problem. The reason for this, naturally, is that the competitive price trend has accelerated during this "buyer's market."

A concrete instance of what I mean by "Value Analysis," as applied to the custom molding business, might best be given in terms of plastic materials selection. As you may know, materials take up one-third of the total cost dollar. For one particular customer, we recommended use of a less-expensive styrene material for an indoor application than a 10% more costly material.

For another, we advised a change from metal to plastics on a motor fan. When adopted, the recommendation resulted in eliminating post-machining and lowering costs. In another instance, we recommended replacing metal with nylon for a new dishwasher's silverware basket, the use of nylon resulting in a 10% cost savings as well as improved performance and appearance.

In addition to materials selection, we have to adapt design techniques and manufacturing methods to best meet the opportunities unearthed by "Value Analysis."

In closing, we recognize the ceaseless challenge that molding better plastic parts at lower costs presents to our business today. Indeed, if you change the phrase "molding better plastic parts" to "making better products," then you can see that the problem on a broader basis faces every aggressive manufacturer. The plastics molder must be constantly involved in the search for improved product design and materials, and lowered manufacturing costs.

—THE END

Photo by Clinedinst

Molding Reinforced Plastic Prototypes in Matched Plastic Dies

Matched cast-plastic dies provide a quick, inexpensive method of prototypes from glass-reinforced plastics for pre-production part testing and evaluation.

JOSEPH N. EPEL, *President*
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Detroit, Mich.

Fiberglass-reinforced plastic prototypes or sample parts are widely used to test and evaluate products contemplated for commercial production by the reinforced plastics industry. The molding of such prototypes in matched plastic dies fills the need for a manufacturing method that saves money and time. The technique, tested over a period of more than three years as a special service to our custom-molding clients, is successful in all respects.

Prototypes of fiberglass-reinforced plastic molded in matched plastic dies are virtually identical in all significant properties with those made in matched metal dies. These comparable properties include wall thicknesses, dimensions, density, and glass-content of the material. As such, the method enables engineers and designers of reinforced plastic parts to pre-test their ideas at reasonable cost, and make any necessary modifications or changes in the prototypes before embarking on the manufacture of expensive metal dies.

Development of the matched plastic die method involved the solution of two basic problems: the creation of plastic dies capable of withstanding the high pressures needed to obtain true prototypes of glass-reinforced plastic; and the effective use of matched plastic dies for molding purposes.

Insofar as we can determine, the development of matched plastic dies with such capabilities is an innovation in the field of molding fiberglass-reinforced plastics. Available experience indicated that such sample parts or prototypes could be made only by the hand lay-up or vacuum bag molding methods. However, parts made by these two methods could not be considered as true prototypes because the absence of pressure in hand lay-up and the very low pressures (about 14 psi.) involved in vacuum bag molding meant that the sample parts they produced were characterized by lower glass contents, lower filler loadings, and greater porosity than production parts. Since these samples did not match the production part in appearance or performance, they were of little or no value for field-testing.

Matched Plastic Dies

Die Construction

The construction of a set of matched plastic dies begins with specifications or prints of the contemplated molded part from which a plaster of paris model of the part can be created. As illustrated in Figure 1, six operations are involved in making the matched plastic dies, as follows:

(1) A female plaster cavity is taken from the original plaster model of the part. Sometimes it is necessary to build up the edges of the model with sheet wax in order to create a proper shearing edge on the finshed plastic die. Such a wax build-up is necessary when no specifications for the part are available, and the dies are being constructed from a hand-made plaster model of the part that is supplied by the customer.

(2) A plaster male pattern is taken from the plaster cavity made in step 1.

(3) The original plaster female cavity is laid up with wax equal in thickness to the wall of the finished molded part.

(4) After this part-thickness wax application, a plaster male is taken.

(5) A female plaster pattern is then cast against this plaster male.

(6) The final plastic male die is cast against this plaster female, while the final plastic female die is cast against the plaster male pattern made in step 2 (see Figure 2).

By this procedure, four items are constructed: a female plaster cavity; a male plaster; and a set of plaster patterns with part-thickness clearance. The plaster patterns against which the finished plastic dies are cast are kept in reserve for any major modifications which cannot be made directly in the plastic dies, and for casting new plastic dies if the original dies are damaged accidentally.

The plaster models should be given a smooth finish before casting the plastic die in order to minimize any sanding or patching of the die surfaces that may be required. Room temperature-curing epoxy resin filled with milled fibers can be used to correct die surface porosity, pin-holes, or blemishes. If sufficient care is not taken when preparing the master patterns, the phenolic die castings will require a final sanding or grinding operation that will raise the cost of the matched plastic die technique.

Die Resins

We have used phenolic casting resins to make the plastic dies primarily because of cost considerations. Epoxy resins have been tested for making the dies and have given excellent results, but their price differential over phenolics and the satisfactory results obtained consistently with phenolic casting resins make the latter the preferred material.

The decision to use phenolic casting resins rather than epoxies left a problem to be solved, in that the epoxies have a lower linear shrinkage and higher flexural strength than the phenolics. These comparative shortcomings of phenolic casting resins were resolved by encasing the phenolic cavity in a sufficiently-rigid steel frame.

The plastic die, thus encased, is subjected to high compressive forces but to little or no flexural or tension stresses. Since the compressive strengths of phenolic and epoxy casting resins are identical for practical purposes, use of the steel frame permitted choice of the phenolics with their lower prices. The recent decline in prices of epoxy casting resins opens interesting possibilities for their increased usefulness in making matched plastic dies.

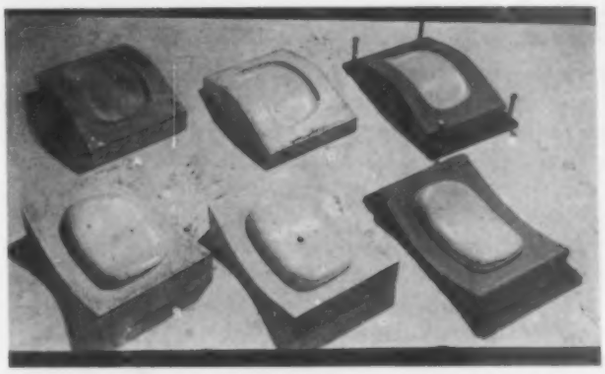


Fig. 1. Components in constructing matched plastic dies: (A) Female plaster cavity taken from model of part; (B) Male plaster pattern taken from female plaster cavity; (C) Female plaster pattern taken from (D); (D) Plaster male taken from (A) after application of part-thickness wax; (E) Final female plastic die taken from (B), shown with steel back-up plate and press stops; and (F) Final male plastic die taken from (C), shown with steel back-up plate.

Molding Pressure

Since high molding pressures are essential to obtain a true prototype of fiberglass-reinforced plastic, the matched plastic dies are subjected to pressure of 70-300 psi. when molding the prototypes. This pressure range is comparable to that used when molding with matched steel dies.

Actually, a molding pressure range of 15-300 psi. could have been specified for the plastic dies to obtain satisfactory results. However, our lowest molding pressure when working with steel dies has been 70 psi., so this figure was used as the lower limit of our recommended molded pressure range. A lower limit of zero pressure, equivalent to hand lay-up, could have been set, but in our work with prototypes we make a consistent effort to keep conditions with matched plastic dies parallel to those with matched metal dies. The figure of 300 psi. was set as the practical upper limit of the recommended molding pressure range because there is no need for any greater pressures.

Fig. 2. In making a female plastic die, casting resin is poured through the back-up plate into male plaster pattern (rght). Shown at left are the plaster female and the back-up plate reinforcements.

Die Reinforcement

The recommended molding pressure range makes it imperative that the female plastic die be reinforced to minimize tension forces. Our experience indicates that the cavity used to make parts having appreciable depth must be encased in a rigid steel frame (see Figure 3). Such a frame is not required for shallow-part plastic dies.

For handling and mounting, both halves of the die are mounted on heavy steel plates. The most effective way to make matched plastic dies is to cast the male die and steel mounting plate as a single unit. This steel plate is made with anchor bolts and reinforcing rods to provide a strong mechanical bond between the steel and the casting resin. The cavity die is cast similarly to produce a single unit with the back-up plate and the steel retainer frame.

If the phenolic cavity is not encased in a steel frame, uneven loading of the fiberglass mat or preform could set up tension forces during the molding operation that could cause the cavity to split.

Die Mounting

The telescope in matched plastic dies must be a minimum of 0.100-inch, and should be constructed at the pinch-off with a clearance of 0.004-0.010 inch. Constructing the telescope at the pinch-off determines whether non-porous moldings will be produced from the dies. If the clearance is smaller than 0.004-inch, broken edges may result. A clearance larger than 0.010-inch will give an over-free flow of resin, preventing the build-up of adequate hydrostatic pressure within the die during molding.

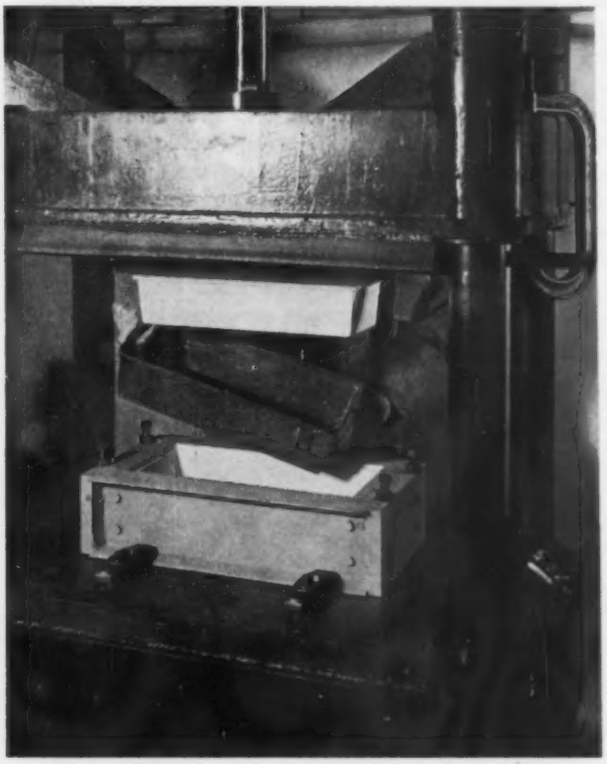


Fig. 3 Molding of glass-reinforced plastic tackle-box prototype part in matched phenolic dies. Deep-walled female die is encased in steel frame, with reinforcing rods indicated by protruding bolts. Press stops are mounted on end-plates of frame.

The plastic dies are mounted on the press in the same manner as steel dies, except that the stops are mounted externally on the dies and, preferably, on the mounting plates or frame end-plates (as shown in Figure 3).

Molding Operations

Molding with matched plastic die is done at room temperature with a two-stage catalyst system for curing. Cobalt-Lupersol DDM is used for the room temperature cure within the die, and benzoyl peroxide is used to insure full strength when the moldings are post-baked at 250° F.

Two methods are used to prevent sticking of the moldings to the dies during the molding operation. When the molded prototype is not to be painted, a single application of a paste wax to the die surfaces prevents sticking. When the moldings are to be painted, a water-soluble parting lacquer is applied to the die surfaces before each molding cycle. Flash can be trimmed from the prototype by either a knife or handsaw (see Figure 4). After the flash has been removed, the edges of the prototype are smoothed by filing or sandpapering.

Features of Matched Plastic Dies

Since parts molded in matched plastic dies are cured at pressures up to 300 psi., the severe limitations on the percentage of filler content in the material that apply with the hand lay-up and vacuum bag molding methods are not applicable. Parts containing as much as 50% carbonate filler have been molded without difficulty in matched plastic dies, as have premix molding compounds containing 50% clay as the filler and chopped sisal fiberglass. This feature of matched plastic die molding extends the comparability of such prototypes with those made in steel dies down to the compounding phase, in addition to appearance and performance.

Since matched plastic dies give satisfactory results with laminates containing mats or preforms and with parts made from premix molding compounds, any mat-cutting dies, preform screens, and other auxiliary tools that may be needed can be made while the matched metal dies are being constructed. The waiting time during matched metal die construction also can be used to make and check assembly and finishing tools.

In the search for a quick, inexpensive technique for making true fiberglass-reinforced plastic prototypes, the essential need is for a rapid and relatively inexpensive method of making suitable dies. Cast metal dies usually cost more than plastic dies as developed by our company. Dies made by casting aluminum or bronze against plaster of paris also proved to be more costly. While sand casting of metal dies begins with an initially lower cost, by the time the die surfaces have been polished sufficiently the total costs are higher than those for making matched plastic dies.

Similarly, the matched plastic die molding technique provides other special advantages. The dies are cast against master patterns made so that no further finish-

(*Continued on next page*)

ing is required, and are ready for use as soon as they have been mounted in the press. The method assures high surface finishes and accurate dimensional reproductions in the prototypes since all critical work is performed in the pattern phase when making the master models and master patterns. The plaster of paris used in the models and patterns is worked far more easily and cheaply than is possible with any other method that was considered and rejected during the development of the matched plastic die technique.

For the same reasons, any needed changes or modifications in the plastic dies can be made easily, quickly and inexpensively. Phenolic die castings can be ground down readily, if necessary, or their surfaces built-up easily with epoxy casting resins. We have found it most efficient to subcontract the plaster and pattern work, leaving us free to concentrate on die design; construction of the back-up plate and reinforcement frames and bars; and the actual casting of the phenolic dies.

Although the matched plastic die molding method was developed originally for making samples or prototypes, as many as 70 pieces have been molded in one set of dies without any signs of die deterioration.

There is no maximum size of molded part which can be made by this technique, since any such limitation is in the size of the press available to hold the metal dies used for production molding of the finished part. Actually, a prototype of a plastic automobile body could be made from matched plastic dies. The larger the press, the more valuable is the matched plastic die technique since size is a major factor in determining the cost of matched metal dies.

—THE END

Fig. 4. Trimming flash from glass-reinforced plastic prototype made in matched plastic dies. Finished prototypes at right.

Robert J. Koch

Ralph J. Gall

The Read Studio

Frank P. Greenspan

In-Situ Epoxidation Process

A simple, practical, and economical in-situ epoxidation process utilizing expendable amounts of resin catalysts has been developed by Becco Chemical Division, Food Machinery & Chemical Corp., Buffalo, N. Y. In a paper before a recent meeting of the American Oil Chemists' Society, Dr. Frank P. Greenspan and Ralph J. Gall of Becco described how the cost connected with the use of ion-exchange catalysts in the manufacture of epoxy plasticizers can be reduced to approximately 0.5-1¢ per pound of final product.

Production of epoxy fatty acid esters, used as vinyl plasticizers, by in-situ epoxidation with an ion-exchange resin has been extremely attractive. Epoxidation processes with ion-exchange resin catalysts, while attractive, have involved certain processing and economic difficulties. In addition to being expensive, ion-exchange resins generally have been employed at a high percentage level, so that 10-20 times reuse of the resin was needed to bring costs down to $0.01 per pound of finished plasticizer. Reuse of the resin poses problems in that the resin swells, is oxidatively attacked, and "fines" are produced which cause filtration troubles.

According to Greenspan and Gall, the expendable resin process utilizes minimum amounts of resin; only 1-2% on the combined weight of hydrogen peroxide and acetic acid in a batch operation. The resin can be thrown away after use (at a cost of $0.005-0.01), and no special apparatus is needed since standard reactors can be used. All that is necessary is to include a filtration step; frequently a part of the refining operations on a finished epoxy plasticizer.

Optimum yields of epoxy ester are obtained at a molar ratio of 0.5 acetic acid to 1.0 ethylenic unsaturation in the presence of a 2% strong sulfonic acid-type cation-exchange resin catalyst. Reaction times are comparatively short (from 7-9 hours), and products with low iodine numbers and yields of 75-85% epoxy ester are readily obtained.

—THE END

Dyed and vacuum-metallized Mylar film forms the decorative surfacing for this chair seat.

Willard Stewart, Inc.

New Dyeing Process for Mylar

A new and continuous method of dyeing all gages of Mylar polyester film with colors that penetrate and become part of the film itself has been developed by Julius Hermes, president of the newly-formed Martin Processing Co., Martinsville, Va. Mylar film, a product of E. I. du Pont de Nemours & Co., Inc., may be dyed in colors and shades ranging from delicate pastels to jet black by the new process which utilizes especially-developed Du Pont dyes.

Mylar dyed by the new process can be used in the manufacture of vacuum-metallized decorative surfacing materials; metallic and plain decorative yarns for textiles; wire servings; and other applications. Since the dyed film also can be given a matte finish, this opens a new range of "soft" metallic colors to metallizers and provides a new type of decorative material when used by itself or in laminations.

According to Mr. Hermes, dyed Mylar film has the following advantages: (1) light-fastness of many colors and shades after 80 hours in the Fade-Ometer; (2) no scuffing or abrasion problems, since the colors are an integral part of the film; (3) heat stability; (4) easy matching of colors and shades; and (5) dyed film can be re-dyed to darker colors. In the continuous dyeing process, the film is first dyed, then washed in boiling soapy water, rinsed in clear water, and dried.

At present, the two most widely used methods of coloring the Mylar film are lacquers and pigmented adhesive coatings. In making metallized fabrics or laminates, the lacquer is applied to the Mylar before metallizing, or pigmented adhesive coatings bond the metallized film to a backing material. To make metallic yarn with the new dyeing process, dyed film is laminated to both sides of an aluminum foil sheet, and the resultant sandwich slit into narrow widths.

—THE END

Swing to Reinforced Plastic Truck Bodies

The change-over to reinforced plastic bodies for delivery trucks is becoming more and more pronounced, according to A. S. Sparkes, president of Permoglas, Inc., one of the largest producers of reinforced plastic products on the West Coast. During the past three months, Permoglas has produced 60 insulated retail milk delivery truck bodies. These bodies are made from Plaskon polyester resin supplied by Barrett Division, Allied Chemical & Dye Corp., New York, N. Y.

In discussing the milk delivery truck bodies made of reinforced plastic, Mr. Sparkes noted that 50 of these units are in service, offering the operators a truck body that is rustproof, light in weight, durable, sanitary, and easy to maintain. In addition, the plastic bodies offer better insulation and temperature control than previous bodies. In the case of one operator, the plastic bodies hold milk temperatures to within 6-8° F. of that registered when the truck left the dairy. This same operator reports that the plastic bodies on his trucks weigh 600 pounds less than their predecessors, producing a saving of approximately $6.00 per day per truck in operating costs.

Mr. Sparkes also stated that plastic truck bodies are seeing increasing application in other types of delivery service, particularly in the meat, ice cream, and bakery industries.

—THE END

Permoglas milk delivery trucks have bodies made of reinforcedpolyester plastic.

Reinforced Plastic Housings for Machine Tools

New housings for machine tools are being made by Gisholt Machine Co., Madison, Wisc., of reinforced plastic and produced with plastic tooling for savings estimated at 20-40% or more. In addition, the lightweight housings also save time and labor in the maintenance and repair of the heavy machine tools.

Plastics are used throughout the production cycle to make the housings. Production molds and fixtures are made with Toolplastik epoxy compounds supplied by Rezolin, Inc., Los Angeles, Calif., utilizing Bakelite epoxy tooling resins. Bakelite also supplies the polyester resins that are combined with fiberglass to make strong reinforced plastic structures for the housings.

To make housing parts for the Gisholt vertical lathe (see Figure 1), production molds are made with the Rezolin tooling compounds. After application of a release agent to the mold surfaces, fiberglass cloth is laid up in strips in the mold and polyester resins brushed on (see Figure 2). The part is formed by the vacuum bag method, the resin hardened by means of infra-red lamps, and the part stripped from the mold when cool. This production mold also serves as a fixture to position the piece for trimming off the rough edges (see Figure 3). The five reinforced plastic panels used to house the lathe motors come from the mold with finished surfaces that require no machining, sanding, or grinding. Their total weight is about 37 pounds, whereas the same panels would weigh more than 300 pounds in cast iron, and about 120 pounds in aluminum.

Estimates drawn from Gisholt's experience indicate the reinforced plastic housings cost 20-40% less to make by this production method than sheet steel or cast steel housings, 20-35% less than cast iron, and 30-35% less than cast aluminum. For example, an average-size housing weighing 10 pounds in reinforced plastic might cost $8-9, depending on its size and complexity. In cast iron, the same piece would weigh 80-100 pounds because of the thicker wall section needed to pour the metal casting. This cast iron piece would cost at least $12.80 as a raw casting before machining, tapping, drilling, and other operations.

The epoxy and polyester resins resist acids, grease, oils, moisture, and most chemicals used by the machine tool industry. The reinforced plastic housings are self-extinguishing, do not warp or change their shape under most weather conditions, and resist abrasion by flying chips or shavings.

—THE END

Fig. 1. Finished reinforced plastic housing for vertical lathe.

Fig. 2. Brushing polyester resins on glass cloth lay-up to make production mold for lathe housing.

Fig. 3. Production mold for lathe housing serves to position piece during trimming operations.

News of the Societies

Advance Program for SPE 1956 National Conference

The Society of Plastics Engineers, Inc., has announced the advance program for its twelfth annual National Technical Conference, to be held at the Hotel Statler, Cleveland, O., on January 18-20, 1956, as follows:

The technical program will consist of three concurrent morning and afternoon sessions during the first two days of the Conference, and a morning session on the third day. The advance programs for these sessions are given below.

Wednesday Morning, January 18

Injection Molding session, moderated by G. B. Thayer, Dow Chemical Co.:

"A New Measure of Plastic Moldability," D. B. Semeyn, Dow Chemical.

"Internal Fin-Type Injection Molding Heating Cylinder," Mario Maccaferri, Mastro Plastics Corp., and R. B. McKee, Dow Chemical.

"Automatic Injection Molding of Thermoplastic Insulators for Automotive Electrical Terminations," D. H. Lewis, Packard Electric Div., General Motors Corp.

"Standards for Injection Molding Machines," A. J. DeMatteo, Watson-Stillman Co.

Epoxy Resin Symposium, moderated by F. S. Swackhamer, Shell Chemical Corp.:

"Development of an Epoxy Resin Potting Compound and a Potting Mold for Precision Pottings," W. H. Crandell, F. S. Bacon Laboratories.

"Long-Term Strength Properties of Reinforced Epoxy Pipe," H. D. Boggs, Fibercast Corp.

"Epoxy-Base Adhesives in the Aircraft Industry," W. Bandaruk, Convair Div., General Dynamic Corp.

"Epoxy Resins in Plastic Tooling," T. R. Sparrow, Republic Aviation Corp.

Properties of Plastics session, moderated by L. F. Rahm, Princeton University:

"The Effect of Explosions on Plastics," H. A. Perry, Jr., Naval Ordnance Lab.

"The Determination of Fracture Temperature of Embedment Castings," L. S. Buckoff, Westinghouse Electric Corp.

"Service Temperature Characteristics of Molded Acrylic Parts," J. J. Gouza and E. N. Robertson, Rohm & Haas Co.

"Application of Radiation to the High Polymer Field," D. S. Ballantine, Brookhaven National Laboratory.

"The Utility of Impact Testing as a Criterion of Toughness," C. H. Adams, G. B. Jackson, and R. A. McCarthy, Monsanto Chemical Co.

Wednesday Afternoon, January 18

Injection and Compression Molding session, moderated by J. H. DuBois, Mycalex Corp. of America:

"Compression and Transfer Molding of Guided Missile Plastics Parts," W. R. McGlone and L. B. Keller, Hughes Aircraft Co.

"Engineering of Purchased Molds," J. C. O'Brien, Shaw Insulator Co.

"The Effect of Heat Treatment on the Polishability of Mold Steel," E. E. Lull, Crucible Steel Co.

Thermoplastic Sheet session, moderated by A. J. Baldwin, Nixon Nitration Works:

"Plug Assist Forming — A New Sheet Fabrication Technique," J. W. Mighton, Dow Chemical.

"Fabrication of Large Area Stretch-Oriented Acrylic Sheet," Alfred Batzdorff, Rohm & Haas.

"Rigid Sheet Plastics — Processing and Preparation," C. K. Henry, Celanese Corp. of America.

"Measuring the Effect of Plasticized Vinyls on Impact Polystyrene," R. R. Dixon, Westinghouse Electric.

"Characteristics of Biaxially Stretch Oriented Acrylics," D. A. Hurst, Rohm & Haas.

Research Symposium, moderated by Bryce Maxwell, Princeton University:

"Flow Behavior of Phenolics Under Molding Conditions," D. I. Marshall, Bakelite Co.

"Plasticity as a Tool in Resin Development and Formulation," G. P. Rowland, Jr., Firestone Plastics Co.

"Physical Properties of Unmodified Rigid PVC," F. W. Schneider, Firestone Plastics.

"Injection Molding Research — Today and Tomorrow," Joseph Eveland, H. J. Karam, and C. E. Beyer, Dow Chemical.

"Tensile Impact—A Simple, Meaningful Impact Test," C. G. Bragaw, Jr., E. I. du Pont de Nemours & Co.

Thursday Morning, January 19

Extrusion session, moderated by H. E. Buecken, National Rubber Machinery Co.:

"Advantages of Cast-In Electric Heaters for Extrusion Equipment," W. H. Norton, Thermel, Inc.

"Stepless and Three-Position Temperature Controls on Extrusion Equipment," R. K. West, West Instrument Corp.

"Problems and Trends in European Extruder Design," E. Gaspar, Projectile & Engineering Co., Ltd.

"A New Development in Extraction-Extrusion—The Vacuum Extruder Screw," E. C. Bernhardt, Du Pont.

"Melt Fracture—Extrudate Roughness in Plastics Extrusion," J. P. Tordella, Du Pont.

"Viscosity Data for Extruder Flow Equations," R. D. Sackett, Monsanto Chemical.

Calendering and Coating session, moderated by J. Leavy, Du Pont:

"Calendering Equipment and the Plastics Industry," R. C. Seanor, Adamson United Co.

"Plastics Coated Fabrics," E. G. Hamway, Textileather Co., Div. of General Tire & Rubber Co.

Reinforcement of Plastics session, moderated by Roger White, Glastic Corp.:

"Non-Glass Reinforcement in Plastics," Johan Bjorksten, Bjorksten Research Laboratories, Inc.

"Practical Evaluation of Reinforced Thermosetting Molding Compounds," P. E. Fina, Fiberite Corp.

"Asbestos-Reinforced Plastic Laminates," D. V. Rosato, Raybestos-Manhattan, Inc.

"Reinforced Plastics in the Construction of External Pressure Vessels," F. R. Barnet and C. L. Lloyd, Naval Ordnance Lab.

Thursday Afternoon, January 19

Plastic Foams session, moderated by E. J. Baruth, Brown Rubber Co.:

"Cellular PVC Plastic and the Chemical Blowing Agent BL-353," H. E. Arnold, Du Pont.

"Polyurethane Foams," C. J. Harrington, Du Pont.

"Vinyl Foam," H. F. Allen, Elastomer Chemical Corp.

"Expanded Polystyrene — Fabrication Methods and Applications," G. R. Franson, Dow Chemical.

Plastic Pipe Symposium, moderated by George Anderson, National Tube Corp.:

"Butyrate Pipe—Properties and Applications," L. W. A. Meyer and R. J. Scogin, Tennessee Eastman Co.

"Kralastic Pipe—Tough, Rigid, Chemically Resistant," P. M. Elliott, Naugatuck Chemical Div., United States Rubber Co.

"Rigid Vinyl Pipe," J. F. Malone, B. F. Goodrich Chemical Co.

"The Properties and Uses of Polyethylene Pipe," C. G. Bragaw, Jr., Du Pont.

Reinforced Plastics session, moderated by Brandt Goldsworthy, Industrial Plastics Co.:

"Problems Encountered in Tooling World's Largest Airborne Reinforced Plastics Component," N. A. Nicholson, Zenith Plastics Co.

"Tooling for Large Radomes," R. H. Vreeland, Hughes Aircraft.

"Applications of Plastics in Marine Cathodic Protection Systems," M. Stauder and N. S. Preiser, Navy Bureau of Ships.

"Fire-Resistant Electrical Grade Polyester Laminates," J. K. Allen, Plywood Plastics Corp.

Friday Morning January 20

Materials Symposium, moderated by Adolph Kisseleff:

"The Effects of Fabrication on the Properties of Teflon Tetrafluoroethylene Resin," P. E. Thomas, J. F. Lontz, C. A. Sperati, and J. L. McPherson, Du Pont.

"Super-Polyethylenes," G. H. Sollenberger, Koppers Co., Inc.

"Silicone Product Development," L. E. Weisbecker, Bakelite Co.

"Cellulose Propionate Molding Powder, Forticel," D. A. Jones, Celanese Corp.

"Polyethylene—Past and Future," G. W. Jargstorff and G. F. Kirkpatrick, Bakelite Co.

Design Symposium, moderated by Otto Wulfert, Wagner Electric Corp.:

"Designing with Transparent Plastics," A. M. Blumenfelt, Rohm & Haas.

"Definitive Specifications for Plastics Materials of Construction," W. C. Wall and R. E. Brooks, Du Pont.

"Designing with Zytel Nylon Resin," A. J. Cheney, Du Pont.

"Analysis and Solution of Decorating Problems," L. E. Parks, Logo, Inc.

Education Committee and Professional Activities Committee, SPE, report session, moderated by Jules Lindau, III, Southern Plastics Co.

In addition to the technical sessions, the conference will include a membership luncheon and business meeting on January 18; a closed-circuit TV showing of Du Pont's Polychemicals' Sales-Service Laboratory in Wilmington, Del., on January 18; the annual cocktail party and banquet on January 19, with an after-dinner talk by Tennyson Guyer, well-known traveller and author; and a three-day program of activities for the ladies.

Newark Section Hears Corbett

A talk on "Extrusion of High Impact Polystyrene Sheet" by H. O. Corbett, chief engineer of the extrusion division, Auburn Button Works, Inc., featured the November 9 regular dinner meeting of the SPE Newark Section, held at the Military Park Hotel. Some 127 members and guests attended the meeting, and received table favors donated by Plastic Molders Supply Co.

Mr. Corbett's talk discussed some of the problems encountered in the extrusion of high impact polystyrene sheet. Take-off rolls heated to 150-200° F. are used for the thinner sheets, while higher tool temperatures are needed for thicker sheets. Auburn is making sheets up to 239 mils in thickness, and the speaker recommended use of a 4½-inch extruder and a four-inch lip land length for the die.

A showing of "Molding Phenolics," the new Bakelite Co. sound motion picture, preceded the talk. Introduced by R. L. Rasmussen, the film described tabletting, types of molds, and molding techniques for phenolics, and featured animated sequences showing what happens to the materials inside the mold. The meeting closed with a drawing for door prizes contributed by Bestway, Inc.

New Resins Discussed

Two new board surfacing resins for applying a decorative protective plastic surface to structural boards by means of low-pressure laminating techniques were described by Richard Lindenfelser and H. P. Ledden, both of American Cyanamid Co., in a paper presented November 14 before the Technical Association of the Pulp and Paper Industry. The new resins, PDL-1-2247 and PDL-1-2352, are experimental materials that provide surface finishes approaching those of standard decorative melamine laminates.

The two resins are used to treat standard decorative print stock and overlay paper, respectively, on conventional equipment. The treated papers may easily be laminated to the surfaces of hardboards, such as Masonite, or low-density particle boards, such as woodwaste or chipboard. Curing is accomplished in 10 minutes at 300° F. and 250 psi., and no adhesive or balance sheets are necessary.

New Officers Installed

The installation of new officers and directors for the coming year highlighted the Nov. 17 dinner meeting of the Northwestern Pennsylvania Section, SPE, held at the Village Hotel, Erie, Pa. The new officers included: president, Aaron P. Wagner, Quinn-Berry Corp.; vice president, James Murphy, also of Quinn-Berry; and secretary-treasurer, Paul Stubbe, Girard Mfg. Co. The new directors added to the Section's board of directors were Robert Way, Finish Engineering Co.; James Collins, Monsanto Chemical Co.; and Mr. Stubbe.

Discuss Factors in Mold Temperature Control

The November 8 dinner meeting of SPE's Milwaukee Section featured joint talks on equipment methods and mold design for mold temperature control by Paul West, Sterling, Inc., and Carl Whitlock, C. H. Whitlock Associates.

Mr. West discussed equipment for mold temperature control, and emphasized the importance of proper equipment in obtaining good control. Good equipment must have simplicity in handling and operating, and be capable of adequate temperature regulating speed and precision.

Mr. Whitlock spoke on the part that mold design plays in mold temperature control; for example, this design has a major effect on shrinkage or distortion of the molded part. It was noted that the faster the temperature-controlling liquid goes through the mold, the better is the chance for uniform molding temperature. Another factor that received emphasis was the placement of heating and cooling channels in the mold in order to obtain uniformity of mold temperature.

Joint Philadelphia Meeting

Over 100 members and guests attended the October 25 joint meeting of Philadelphia Sections of SPE and SPI, held at the Franklin Institute, Philadelphia, Pa. "Recent Developments in Vacuum Forming" was the topic of the meeting, which included two technical speakers from Dow Chemical Co.

Jack W. Mighton spoke on "Plug Assist Forming," covering recent developmental work on this new technique. The operation itself was described, and slides were shown to illustrate the possible applications. Plug assist forming is expected to assume an importance equal to the "straight" and drape methods.

"Extrusion and Continuous Vacuum Forming of High Impact Styron Sheeting" was discussed by Robert T. Johnson, who outlined advantages and drawbacks of several types of integrated operations. The prime reason for interest in an integrated sheeting and forming operation is said to be control by the fabricator over all major factors affecting production and quality. Corrective steps can be taken before large quantities of defective parts have been produced.

Vacuum Metallizing Discussed

Some 44 members and guests attended the October 19 dinner meeting of the SPE Toledo Section, held at the Wellington Hotel, Napoleon, O. The technical program included an after-dinner talk on "Vacuum Metallizing of Plastics" by Morgan Jones, Red Spot Paint & Varnish Co., followed by a plant tour of Perfection Finishing Co. in Napoleon to view the company's vacuum metallizing operations.

Mr. Jones explained in considerable detail the physical factors involved in vacuum metallizing, and gave a discussion of the theoretical aspects of molecular activity during the low-vacuum phase of the operation. Also described were the mechanical and diffusion pumps used to produce the high degree of vacuum necessary for the operation; the complete sequence of operations in the metallizing cycle; and the adaptability of a wide variety of materials to the process.

Considerable emphasis was placed by the speaker on the role of protective finishes and coatings in the metallizing process. The requirements of the resin base coat and top coat were reviewed, and the speaker discussed the problems of frosting, cratering, poor adhesion, and poor mar resistance which may develop from an improper choice of coatings or their improper application.

New York Section Sponsors First Regional Conference

"Plastics for Packaging" was the theme of the SPE's Atlantic Regional Conference, which was held November 16 at the Hotel Statler in New York City. Sponsored by SPE's New York Section, the meeting included an all-day technical symposium which was attended by 178 members and 120 guests. Fourteen states were represented, and three foreign countries. Lunch and dinner were servd.

Anthony Dragonette, Bakelite Co., opened the morning session with a talk on "Vinyl Plastic Packaging," discussing applications, processes, advantages, and potential markets for calendered and cast vinyls. He covered the field of vacuum formed packages and containers, which include unplasticized, flexible, and semi-rigid films. Of particular interest is the skin-type package, where the film covers and protects the product while securing it firmly to a cardboard base. Preheated films are forced around the item by atmospheric pressure after a vacuum is drawn. Variations of the method include the recess pack and the bubble pack.

"Cellulose Acetate's Role in Packaging" was the topic of an address by Robert B. Carter, Celanese Corp. of America. Thin gage (0.5-2 mil) cast and extruded film is used for plain and printed wraps, transparent bags and envelopes, window bags, and window boxes. It can be used in combination with other materials by lamination to kraft paper, cardboard, metal foil, fabric, and saran to obtain a balance of properties. Other forms used in packaging include cast and extruded sheeting, molded containers, and extruded tubes.

E. V. Hellyar, Monsanto Chemical Co., spoke on "The Role of Styrene in Rigid Packaging," where clarity, dimensional stability, and light weight are combined with low cost. Colors are possible, and transparent, translucent, and opaque effects can be obtained. Some of the most attractive, "throw-away" packagings are made of styrene, and molded, rigid dispenser packs and vials have replaced glass in numerous applications.

Spencer Chemical Co.'s Mark Stringfellow spoke on "Polyethylene from Here to '60," reviewing estimated capacity, production, and consumption, as well as prophesying areas of future growth. Four primary reasons for the material's ever-increasing use in the packaging field are: faster selling by personal selection; reduced losses from soilage; increased floor space; and increased unit sales.

T. H. Derby, Sylvania Division, American Viscose Corp., spoke on "The Versatility of Cellophane," which combines sales appeal with protective qualities. Introduced 40 years ago as a luxury packing, cellophane has been reduced in cost to the point of becoming the workhorse of the transparent packaging industry. The material can be produced in varying degrees of moisture-proofness, and is regularly impervious to dry gases. It can be heat-sealed or joined by adhesives, and is adaptable to automation. Other machineable properties include uniformity of gage, good tensile strength, rapid heat-seal, and freedom from static electricity.

"Mylar Polyester Film for Packaging" was covered by J. L. Jenemann, E. I. du Pont de Nemours & Co. The interesting feature here is the balance of properties rather than dramatic appearance. Where visibility is demanded, Mylar offers crystal clear transparency; yet it has been widely used in metallized form for the trim on autos. Moisture-proof properties are similar to those of comparable gages of polyethylene.

"Expandable Polystyrene," as discussed by E. A. Edberg, Koppers Co., is capable of producing an endless variety of shapes and forms. Extruded foams, colored by dry-blending, offer useful properties in three fields of packaging. They can be used by the military to cushion precision parts in transit. They can be used both as a tote box, and as a vehicle in which to suspend delicate parts. "L" and "U" shaped sections protect edges and corners of furniture and glass. Lastly, they offer eye-appeal through freedom of design.

"Visqueen Polyethylene" was discussed by James F. Bernard of Visking Corp., who brought out the following reasons for the material's acceptance by the packaging industry: economy, toughness, excellent aging properties, non-toxicity, chemical resistance, unique gas transmission properties, low-temperature flexibility, light weight, printability, ease of fabrication, and eye appeal. It is also reported to be the least expensive of the transparent packaging materials.

"Plastiatrics of Rigid Molded Packages" was the topic offered by E. L. Kropscott, Dow Chemical Co. With respect to the injection molding of packaging materials, the following developments were said to have played a dominant role in their acceptance: mold temperature control, restricted and balanced gating, controlled plastic flow, preplasticizing, and weighed feeding. The three steps required for the successful molding of a rigid plastic package are rapid mold filling at correct temperature; trapping rather than packing the mold; and cooling before ejection to assure a minimum of stress.

W. D. Lahey, B. F. Goodrich Chemical Co. spoke on the use of vinyls in packaging, covering the following applications and processes: lid sealers, sponge cushioning, coated glass containers, vacuum formed boxes, dipped goods, blow molding, rotational casting, slush molding, and packaging tapes.

Lloyd Stouffer, "Modern Packaging," spoke on "The Future of Plastics in Packaging," covering the past history and the expected future of each material. The outlook is reportedly excellent, due to plastics' low cost, big volume production, practicability, and expandability. This is particularly significant in the light of plastic's recent entry into the packaging field (just 10 years ago this month).

Plastic packaging is still in its infancy, according to Egmont Arens, designer and consultant. Plastics now provide low-cost solutions to many types of packaging problems, while resembling luxury items. Good design is indispensable for upgrading the industry, and plastics offer a designer's delight through their unique properties and three-dimensional forms.

Automatic Molding Discussed

A talk on automatic molding by Ernest P. Moslo, president of Moslo Machinery Co., highlighted the November 31 dinner meeting of the SPE Miami Valley Section, held at Schuller's Restaurant, Cincinnati, with some 31 members and guests attending.

In discussing automatic injection molding, Mr. Moslo emphasized that high speed injection is required to fill the mold during the comparatively short flow life of the material to obtain best results. The mold clamp must close rapidly and have adequate tonnage to produce good moldings. With these higher speeds, a better plasticized material will mold larger areas in a given clamp tonnage.

Time, temperature, pressure, and cooling of the part in the mold are very critical factors, the speaker asserted. Variations in any of these factors will cause dimensional instability and other troubles in the molded parts. In automatic molding, these factors are held constant, so that uniform parts are made.

All automatic molding is not necessarily high speed molding, Mr. Moslo stated. It may be economically feasible to run multi-cavity molds on a comparatively long cycle on a small machine, but with adequate plasticizing capacity the parts may still be molded in half the time of a conventional injection machine. Yet inexpensive single-cavity molds often produce more parts on a high-speed automatic injection machine than does a multiple-cavity mold on a larger, slower semi-automatic machine. So each individual job must be analyzed as to the merits of automatic molding.

The following officers for 1956 were elected by the Miami Valley Section: president, Jacque Barnhiser, National Cash Register Co.; vice president, Ray Adams, Adams Plastic Products Co., secretary, Paul Caldwell, Plastics Research Products; and treasurer, B. L. Allen, Recto Molded Products, Inc.

Discuss Engineering Design

"Plastics for Industrial Engineering Applications," by W. C. Wall, E. I. du Pont de Nemours & Co., was the featured talk at the November 22 regular joint meeting of the SPE-SPI Philadelphia Sections, held at the Franklin Institute.

While generalizations are difficult to make in so broad a field as plastics, Mr. Wall said, good design in plastics stems from an intimate and complete knowledge of material properties. Primary property requirements must be considered by the designer, but he must not neglect to design for all possible service requirements. To illustrate this point, the speaker discussed good and bad designs that have been made from Du Pont materials, and showed slides of these applications.

NEWS of the INDUSTRY

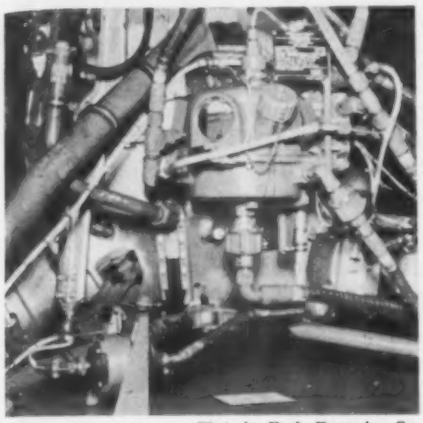


Photo by Eagle Engraving Co.

Fluorocarbon sight glass reveals oil level in helicopter transmission.

Employs Fluorocarbon Viewers

Oil level sight glasses made from Kal-F trifluorochlorethylene are standard equipment on all helicopter transmissions produced by Sikorsky Aircraft Corp., Bridgeport, Conn. A product of M. W. Kellog Co., New York, N. Y., Kel-F is shatterproof and resistant to corrosion, aging, extreme temperatures, shock and abrasion.

Chemically-inert, the sight glasses reportedly retain their clarity when ordinary materials would be covered with sludge deposits. The plastic does not swell, shrink, or lose its rigidity over a temperature range of —65 to +300° F. Exceptionally high compressive strength and resiliency permit mounting bolts to be pulled tight to prevent leaks without cracking and shattering. The high impact strength of the material prevents damage by tools or rough handling by the mechanics.

Non-sticking characteristics of fluorocarbons minimize sludge accumulation, and the number of clean-outs to restore visibility is reduced. The sight glasses are molded by Nichols Engineering, Inc., Shelton, Conn., from ⅛-inch thick sheets. A special process is used to obtain clarity. Standard machining techniques and tools are used to true the edges, drill and counter-sink bolt holes, and engrave specified markings.

U.S.I. to Build New Plant

What is claimed to be the first commercial plant in the world for the production of isomers of sebacic acid, known as U.S.I. Isosebacic acid, will be built at Tuscola, Ill., by U. S. Industrial Chemical Co., a division of National Distillers Products Corp., New York, N. Y. The plant is scheduled for completion early in 1957, and will have an initial production capacity of 10,000,000 pounds per year.

U.S.I. Isosebacic acid is the result of more than three years of research. For the past two years, it has been in pilot plant production first at the company's former Fairfield, Conn., plant, and more recently in new pilot plant facilities at the Cincinnati Research Laboratory. The Cincinnati unit will continue to supply samples of the material and develop further process refinements until the Tuscola plant comes on stream. Tuscola was chosen as the site for the new plant because of the availability of raw materials to make the product; hydrocarbons from National Petro-Chemicals Corp., as well as sulfuric acid and other raw materials from the adjacent U.S.I. installation.

Plastics in Atomic Show

The plastics industry is expected to play a major role in the atomic age, and confirmatory evidence for this viewpoint is to be found in the preliminary list of exhibitors for the Atomic Exposition, to be held in conjunction with the U. S. Nuclear Congress in Cleveland, O., on December 10-16. Some 26 technical societies and management groups, having a membership in excess of 400,000, are participating in the Congress.

Peacetime applications of atomic fission and radiation, and related nuclear applications will be featured at the Exposition. Equipment to be displayed ranges from atomic power reactors to remote control handling equipment, instruments, and various types of gages and inspection devices using isotopes as the energy source. Much of this equipment will be getting its first public showing at the Exposition.

Announces Expansion Plans

Plans to triple production capacity of vinyl chloride paste resin have been announced by Monsanto Chemical Co.'s plastics division, Springfield, Mass. Immediate construction of new facilities is scheduled, with actual operations commencing by the second quarter of 1956.

The resins are stir-in formulations which are easily compounded into plastisols for fabric coating, slush molding, and for the production of foams. Use of paste resins eliminates milling and grinding operations during the compounding process.

Record Advance Registration for 1956 Plastics Exposition

Advance registration for the 1956 National Plastics Exposition, to be held at the new Coliseum in New York City on June 11-15, is more than 42% ahead of registrations received at this time for the 1954 show in Cleveland. At the drawing to determine the distribution of booth space among the advance registrants, William C. Conroy, chairman of the exposition committee, reported that 178 exhibitors have already signed up, including 55 companies exhibiting for the first time. The total number of exhibitors is expected to reach 250 by the time the show opens.

Held under the sponsorship of the Society of the Plastics Industry, Inc., the Exposition is expected to draw more than 20,000 representatives from industry, business, retailing, government, and education. The show will not be open to the general public. Exhibitors already registered for the coming Exposition include molders; laminators; extruders; fabricators; makers of reinforced plastic products; processors of film, sheeting, and coated fabrics; raw material suppliers; machinery and equipment manufacturers; and tool, die, and mold makers.

Photocraft Associates

Exhibit booth lay-out for 1956 National Plastics Exposition is discussed by (l. to r.): William C. Conroy, Erie Resistor Corp. and chairman of the exposition committee; Ken Knowles, Clapp & Poliak, Inc., exposition managers; William T. Cruse, SPI executive vice president; and Thomas A. Henry, Firestone Plastics Co. and chairman of the exposition's publicity and public relations committee.

Rohm & Haas To Build

Four and one-half acres in Niles, Ill., near the Chicago city limits, have been purchased by Rohm & Haas Co., Philadelphia, Pa., as a site for a warehouse and office building. These facilities are expected to be ready for occupancy before the end of 1956. The company has maintained a branch sales office and stocks of certain products in rented quarters in Chicago. Now, these operations will be integrated into a single modern building. Products to be warehoused include plastic molding materials and synthetic resins used in the manufacture of paints and industrial coating, leather chemicals, and agricultural and sanitary chemicals.

Celanese to Make New Plastic

The inauguration of large-scale commercial production of Forticel cellulose propionate plastic is under way at the Belvidere, N. J., plant of the plastics division, Celanese Corp. of America, New York, N. Y. This operation gives the company another line of plastics in addition to cellulose acetate, polyethylene, polyvinyl acetate emulsions, and polyester resins. The decision to go into commercial production of the new plastic was based on assured sources of high-quality propionic acid at the company's Pampa, Tex., chemical plant, and of alpha-cellulose at affiliated plants in Canada and Mexico.

According to Bjorn Andersen, general manager and vice president of the Celanese plastics division, Forticel is a free-flowing thermoplastic material with a good balance of properties: it is dimensionally stable; has good form retention; has surface hardness without brittleness; is odorless even at the high temperatures of injection molding; and can be supplied in a wide range of colors. Suitable for injection and extrusion molding, the material has a short molding cycle which, in some cases, amounts to a 25% increase in production per machine.

Union Carbide Gets Phillips License for Polyethylene

Union Carbide & Carbon Corp., New York, N. Y., has concluded an agreement with Phillips Petroleum Co., Bartlesville, Okla., for a license under the Phillips patents on low-pressure polyethylene. According to George C. Miller, president of Union Carbide's Bakelite Co., Carbide has rights under the agreement to produce polyethylene of the general type identified by Phillips' Marlex. This material differs somewhat in certain properties from low-pressure polyethylene obtained by the Ziegler process, under which Carbide is also licensed.

Although the new materials, when readily available, are expected to have some effect on markets presently served by high-pressure polyethylene, Mr. Miller said, the major effect will be on markets presently served by other materials. Union Carbide is the world's largest producer of high-pressure polyethylene, with an annual production capacity of more than 225-million pounds from three existing plants, and another plant with an annual capacity of 60-million pounds coming into production in the near future.

Holiday Leases Factory Unit

Holiday Plastics, Inc., recent acquirer of the Thermacote companies, has leased new production headquarters at 1301 Fairfax Trafficway, Kansas City, Kan. Covering 84,000 square feet of floor space, the new facilities are expected to provide ample room for tripling production in the near future. Previous headquarters in Kansas City, Mo., will be vacated by January 1.

rians Canadian Geon Plant

A $3,500,000 chemical plant for the production of Geon vinyl resins will be built by B. F. Goodrich Canada, Ltd., between Welland and Niagara Falls, Ont. Construction will begin early in 1956, and completion is expected early in the following year. A technical staff from the Canadian company will work in cooperation with engineers from B. F. Goodrich Chemical Co., Cleveland, O., both in the design and in the actual construction.

The factory will be manufacturing primary raw materials and, therefore, will not require a large staff. It was pointed out that this Canadian expansion is in step with the rapid progress of the chemical industry, which requires high capital investment per employee. The plant site was chosen because of its proximity to an adequate supply of basic raw materials, and is in the center of an already-established chemical community.

Offers Plastic Design Concept

Preliminary design sketches for an experimental "house of tomorrow" have been released by Monsanto Chemical Co.'s plastics division, Springfield, Mass. Basis of the novel concept is a molded module, eight by 16 feet in size, which is bent to form the ceiling, wall, and floor.

The simplest plan involves eight modules which are cantilevered in pairs from a 16-foot-square central utility core. The proposed house is not simply a plastic house, however, but a major element in Monsanto's broad program to develop sound uses for plastics in the construction industry.

Final design is being refined at the Massachusetts Institute of Technology by architect Marvin Goody, and should be completed by the end of the year. Several combinations of design components should make it possible to achieve a variety of floor plans. A minimum of site excavation is required to accommodate the utility core, and elevation is easily adapted to the terrain.

Structural and decorative components include: lightweight, movable partitions combining various core and face materials in sandwich-type constructions; decorative plastic laminates for wall and table tops; fibrous glass-reinforced polyester panels for light control, both inside and out; plastic conduits and piping integrally formed into wall and floor sections; extruded plastic gaskets and stripping for sealing and joining panel sections; and foamed plastic insulation.

Artist's conception of Monsanto's molded module house.

Ray-O-Lite awning withstands man-made hurricane.

Awning Resists Hurricane Test

Recent tests conducted at the University of Miami's housing research laboratory in Coral Gables, Fla., have demonstrated the ability of Ray-O-Lite's Regency fibrous glass-reinforced polyester awning to withstand hurricanes. A Pratt & Whitney radial airplane engine provided water-laden winds at velocities up to 145 mph., for two minute durations.

The awning not only proved its durability, but reportedly remained serviceable. The new awning is available from the Ray-O-Lite Corp., Atlanta, Ga., encased in an aluminum frame, and in color tones of blue, green, yellow, white, and coral.

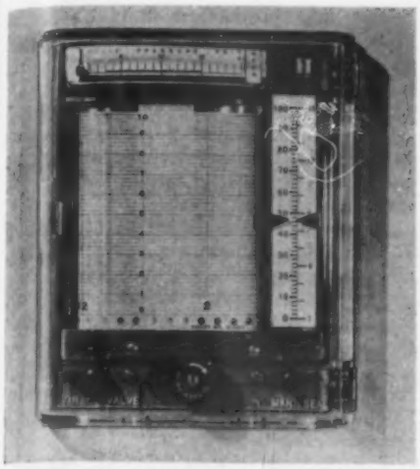
New Borden Service Lab

A new service laboratory, designed to give close-to-home help to Pacific coast producers of water-based paints, has been opened by the Polyco Department of Borden Co.'s chemical division at its Los Angeles, Calif., plant. Directed by Harold L. McKinsey, formerly with Borden's chemical laboratories in Peabody, Mass., the new lab will permit quick handling of problems related to the use of polyvinyl acetate emulsions and butadiene-styrene latices in paints. The new lab also will service as a Pacific Coast outlet for information resulting from research at Peabody.

Molded Alkyd Brackets Chosen

Shock absorbent, reinforced alkyd brackets, molded from Barrett's Plaskon 446, have been selected by Soreng Products Corp., Schiller Park, Ill., for mounting its electrical switches in automatic door latches of refrigerators. In addition to high impact strength, the material is said to offer durability and good insulating properties.

Fastener holds are molded in each bracket, thereby saving machining costs. Three brackets make up a mounting unit; the top and lower two brackets mounting the switch to the refrigerator liner, and the third forming part of the switch itself. The brackets, which were molded by Whitso, Inc., Schiller Park, Ill., were required to pass a life test of a half-million operations.



Tel-O-Set recorder has Plexiglas Acrylic Door.

Selects Acrylic Recorder Door

The unique properties offered by acrylic plastics have resulted in the specification of a molded Plexiglas door as standard equipment for the Tel-O-Set recorder, a recent introduction by industrial division of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Combining control and recording functions, the instrument was designed for use in modern graphic panels where a complete diagram of the process is drawn on the panel board, and instruments are inserted at points corresponding to points of measurements.

Requirements for the door included a material easily molded to precise dimensions, with optical clarity, availablity to withstand impact, and chemical resistance. Design was evolved by the manufacturer in cooperation with Rohm & Haas Co. engineers, suppliers of Plexiglas, and with Boonton Molding Co., Boonton, N. J. The latter firm injection-molded the part in single-cavity molds, avoiding stresses and flow marks. A long cycle was used to control shrinkage, which could have prevented hinge seat registration and latch engagement.

The door measures 4 by 5¾ by ⅞ inches, and is molded to a thickness of 3/16-inch. Weighing only 4¼ ounces, it permits the use of 11/16-inch long, unobtrusive hinges.

Koppers' Award Scholarships

Five scholarships in industrial design will be the top awards in the second Housewares Design Competition for plastic molders, sponsored by Koppers Co., Inc., Pittsburgh, Pa. The 1956 competition has been expanded to include polyethylene as well as polystyrene, and deserving students will be awarded the grants in the name of the molder or proprietary manufacturer originating the prize design.

A two-year, full-tuition scholarship heads the list for the product rated "Best of Competition," and one-year, full-tuition scholarships will be awarded to the first-prize winners in each of the following four classifications: polystyrene products designed for use in the preparation, serving, or storage of food; polyethylene products designed for the same usage; polystyrene or polyethylene products designed for decorative purposes; and products of either material designed for home maintenance use.

Items entered in the competition may be molded, extruded, or fabricated from regular, modified, or foamed polystyrene, or from modified or regular polyethylene. Production samples must be received by the Design Competition Administration Committee, 1313 Koppers Building, Pittsburgh 19, Pa., no later than January 31, 1956. Winners will be announced at an Awards Dinner sponsored by Koppers on March 14, 1956 in Pittsburgh.

New Formaldehyde Plant

A new formaldehyde plant that will double its West Coast output of the chemical is planned by the chemical division of the Borden Co., New York, N. Y. To be built in Seattle, Wash., and scheduled for completion late in 1956, the new plant will be geared to produce more than 36,000,000 pounds of formaldehyde per year. The expansion is necessitated by new demand for the chemical that is far beyond the capacity of the company's Springfield, Ore., plant. With the Seattle operation supplementing the existing plant's output, Borden will be in a position to serve the entire area from Western Canada to San Francisco Bay. The new plant will be under the direction of Ray T. Hanson, the division's West Coast general manager, who also manages the Seattle plant.

To Build New Service Lab

A new sales service laboratory is under construction by Phillips Chemical Co., Bartlesville, Okla., adjacent to the large chemical research laboratories being built by the parent firm, Phillips Petroleum Co., at the Phillips Research Center in Bartlesville. The new structure will provide space for a wide variety of services and facilities needed for Marlex 50, the company's new ethylene polymer which will become commercially available in 1956 upon completion of a manufacturing plant now being built.

The new laboratory will have the latest equipment for evaluating, converting, and fabricating plastics, especially the Marlex polymers. A resident staff of sales service and development engineers is now preparing for customer service, development and proving of new uses for Marlex, and product evaluation. In addition to offices and conference space, the lab will have complete facilities for physical, chemical, and electrical testing, and extensive molding, extrusion, and converting equipment. The one-story structure will provide 15,000 square feet of floor space, and be completely air-conditioned.

Architect's drawing of Phillips' new Marlex sales-service lab.

Provides Expansion Capital

A new financing plan for plastic companies in the State of Michigan has been announced by Prudential Acceptance Co., Detroit, Mich. The plan reportedly provides both long- and short-term funds from local banks and Prudential, to be used by plastic companies in the purchase of new equipment, to expand working capital, and to increase sales.

The need for such new financing is described in a Prudential report, entitled "Growth of the Plastics Industry in Michigan," which indicates long-term financing as the basic need of Michigan molders and extruders. "Long-term capital is presently available only if the owner wants to sell out a sizeable portion of his company and lose control," according to the report, "thereby eliminating the possibility of growth."

Prudential, the Michigan division of James Talcott, Inc., will now advance capital on the basis of accounts receivable, and will provide additional money for equipment. Short-term loans will be advanced by local banks, with Prudential administering the entire financing operation for the bank and itself.

Atom Sub Uses Acrylic Plastic Spray Shield

The same acrylic plastic used as glazing in aircraft, boat windshields, and sports car windshields serves as a spray shield atop the conning tower of the Navy's atomic submarine, Nautilus. The high surface speed of the sub requires protection of the conning tower look-out man. After a study of the requirements for the shield, which included optical quality, retractibility, and resistant to impact, wind pressure, weather, and salt spray, the sub builder, Electric Boat Div. of General Dynamics Corp., specified Plexiglas, a product of Rohm & Haas Co., Philadelphia, Pa. The contract for fabricating the shield was awarded to Steiner Plastics Mfg. Co., Glen Cove, N. Y.

The shield was made from a ¾-inch thick, single transparent sheet measuring 53 by 80 inches. It was free-blown by air pressure to a quarter-sphere form within very close tolerances so that accurate bearings could be taken through the Plexiglas at all headings. The shield then was reinforced on both edges to permit secure mounting to a hinged bracket which folds it downward into the conning tower before the ship is submerged. Acrylic resin cement was used to bond the acylic sheet to the glass fiber reinforcing strips.

Press Hose Failures Eliminated

Steam hose failures on molding presses were eliminated by Pro-phy-lac-tic Brush Co., Florence, Mass., by installation of a new type of hose assembly, Resistoflex R-3800, made by Resistoflex Corp., Belleville, N. J. The brush company, also a custom molder of thermoplastic and thermosetting plastic products, has batteries of 100-ton presses which have hose to feed steam at 170 psi. pressure and a temperature of 340° F. to the press rams and beds to keep the molds at a uniform temperature.

The hose is subjected to constant flexing, since the presses move up and down on a 50-second cycle for approximately 22½ hours each working day, and the company's maintenance engineers found that ordinary flexible hose had to be repaired after three months of use. After investigating a number of different hose materials and designs, the engineers selected Resistoflex R-3800 which has a hose tube made of smooth, specially extruded fluorocarbon resin, jacketed in stainless steel wire braid. In addition to high tensile strength and resistance to corrosion and fatigue, the assembly provides a blow-off proof anchor for the couplings.

Textron American Buys Kordite

Textron American, Inc., has purchased the Kordite Corp., Macedon, N. Y., manufacturers of plastic clothesline, garment and produce bags, and other polyethylene plastic products. Organized in 1946, Kordite will embark on an expansion program to increase the facilities of its Macedon plant and to erect a new plant in California. According to Royal Little, board chairman of Textron American, the Kordite purchase was for cash plus a percentage of future earnings. Textron American was formed last February following the merger of American Woolen Co. and Robbins Mills into the former Textron, Inc.

Borden Plans Plant Expansion

An increase of 25% in the productive capacity of its Illiopolis, Ill., plant is planned by the Polyco Department, Borden Co., New York, N. Y. Scheduled for completion by early June, the expansion program calls for the construction of a new one-story building, and the installation of stripping and storage tanks, totalling 50,000 gallons in capacity, for resin emulsions. The new building will be constructed to allow for future addition of a second story.

Growing demand for Polyco butadiene, styrene, and vinyl acetate emulsions by the adhesive and paint fields has made the expansion necessary, according to S. J. Baum, Polyco general manager. The increased storage space will permit overnight tank truck delivery of standard Polyco emulsions throughout the Midwest.

Home Builders Need Plastics

Chemicals, particularly plastics, are making substantial contributions to modern home construction. This was emphatically brought out at the opening of the National Housing Center, Washington, D. C., early in October. On display were the latest and best of the home building industry's new products, as assembled by the National Association of Home Builders.

Kitchens and bathrooms abound with plastic applications, ranging from vinyl and styrene tiling to plastic-vitreous china blends. Plastic foams provide both insulation and an adherent surface for plaster; polyethylene film forms a vapor barrier under concrete foundations; and woven plastic-coated fiberglass serves as rustproof screening.

These are but some of the many applications for plastic in the modern home. Recent estimates indicate 400 million pounds of plastic going into building contruction each year. Dollar-wise, this represented $224-million in 1954, with this year's estimate approaching $240-million.

All-Vinyl Spray Header Unit

A rectangular-shaped spray header system using rigid vinyl piping exclusively, has been constructed by Barber-Webb Co., Los Angeles, Calif., for use by a large West Coast aircraft plant. Measuring 13 feet long, the system uses 82 feet of ½-3 inch I.D. Koroseal pipe which is supplied by the B. F. Goodrich Co. Industrial Products Division, Akron, O.

The spray system will be used for metal bond cleaning of air-frame parts where exterior exposure to acid would cause metal corrosion. The header itself will carry demineralized water for washing the parts after their acid pickle bath.

Besides the pipe sections, Koroseal T's, reducing bushings, L's, caps, and companion flanges will go to make up what is reportedly the first spray unit using no metal parts. There are 48 spray orifices.

Koroseal spray header unit being assembled.

New Mobay Plant and Lab in Operation

The first production units ot Mobay Chemical Co.'s new multi-million dollar plant at New Martinsville, W. Va., went on stream November 18. These units are for the manufacture of special-type polyester chemicals, and the company expects to place the balance of the plant, for the production of isocyanate chemicals, in operation in December.

The plant, on a 100-acre site, contains 20 structures, including an office building, manufacturing units, warehouses, machine shops, and a research laboratory. Nearly four acres of floor space are provided in the buildings; many of the manufacturing units being of the "outdoor" type. Currently, 150 persons are employed by Mobay at New Martinsville, including a 60-man research department.

The research laboratories are occupied and in complete operation. The lab is a 40,000-square foot, three-story building intended for process development, application research, and testing of materials for the urethane field. Five complete modules make up the building; each module contains two standard 20 by 30-foot, four-man laboratories; a specialized utility laboratory; and two 10-foot-square cubicles. An open bay, containing 8,400 square feet of floor space, has been provided for application research machinery, including a full-scale foam machinery, several lab-size foam machines, and a wire-coating machine.

In Brief . . .

Bjorksten Research Laboratories, Inc., Madison, Wisc., will function as a special laboratory exclusively for the performance of contracts for the Armed Services and various government agencies. Industrial and other types of non-government research will be handled by a new firm. Bjorksten Research Laboratories for Industry, Inc., also in Madison. This separation of the two operations will benefit industrial clients, since they will not be burdened with the extra overhead costs resulting from the extensive record-keeping required under government contracts.

Manufacturing Chemists' Association, Inc., Washington, D.C., will sponsor the third annual Chemical Progress Week on April 23-28, 1956. The program for the Week will be national in scope, with emphasis on local level activities aimed at telling the public of the significance of the chemical industry in their daily life.

Dow Chemical Co., Midland, Mich., has announced an expanded program of consumer education and research, and appointed Margaret B. Doughty as director of consumer education.

(Continued on page 721)

News from Abroad

Symposium on Polymers

An International Symposium on Macromolecules, sponsored by the Commission on Macromolecules of the International Union of Pure and Applied Chemistry, will be held in Israel from April 3 to April 9, 1956. Host to this Symposium will be the Weizmann Institute of Science, Rehovoth. The Symposium will be devoted to the behavior of polymers, biocolloids, and polyelectrolytes in solution. Papers will be presented in three sections to be held successively: (1) General Behavior of Polymers in Solution; (2) Behavior in Biocolloids and Polyelectrolytes in Aqueous Solutions; and (3) Behavior of Special Polymeric Systems. Further information is obtainable from the Weizmann Institute of Science, Rehovoth, Israel.

Czech Plastics Exhibit

An exhibition of Czechoslovakian plastics, held in London last June and organized for Chempol of Prague by its representatives in England, East Anglia Plastics, Ltd., London, made it clear that Czechoslovakia is making rather successful efforts to keep abreast with various modern developments in this field. On view were rigid and plasticized PVC; a special modified rigid PVC for use in surgery and for splints; phenol-formaldehyde molding powders; Silon, a nylon-type polyamide molding powder; as well as acrylic sheet and polyester resins. A wide variety of finished goods was also on display, including technical articles of Silon, phenol-formaldehyde, and PVC for the electrical, chemical, and radio industries, railways, fancy goods, garments, and general consumer goods.

Scotch Polyethylene Plant

Plans for the construction of a polyethylene plant near Grangemouth, Scotland, have been announced by Union Carbide & Carbon Corp., New York, N. Y. The new facility will have an annual capacity of 26 million pounds, and will be operated by Gemec Chemicals Co., a subsidiary of Union Carbide, Ltd. Bakelite, Ltd., another subsidiary, will market the plastic.

The Scotch plant will be the first polyethylene plant built by Union Carbide in Europe, and will cost upwards of $12-million. Union Carbide's polyethylene capacity, both domestic and foreign, should approximate 290 million pounds by 1957.

Australian Plastics Fair

The Plastics Fair of 1955, held in Sydney from July 13 to July 21, 1955, was organized jointly by the Plastics Institute of Australia and the journal, "Australian Plastics." It was highly successful, showing a gratifying advance over the first Australian plastics exhibition held the preceding year. Some 35 firms participated, including the most important manufacturers of plastics established or represented in Australia.

Locally produced PVC, by I.C.I.A.N.Z., Ltd., and polystyrene by Monsanto Chemicals (Australia), Ltd., and C.S.R. Chemicals, Ltd., bore witness to Australian advances in the field of plastics production. Progress in applications exemplified by the polyethylene products, including tubing for irrigation, shown by A.C.I. Plastics; the polyvinyl acetate, melamine, urea, and phenolic compounds of Bettle-Elliott, Ltd.; the high-impact polystyrene sheet and polyethylene pipe of Walter Barr Pty., Ltd.; and Sarmprene polyester-based foam (made by South Australian Rubber Mills, Ltd.) displayed by Holmesdale Pty., Ltd.

Among other interesting applications featured were Novolon Nylon bushings, and various types of supported PVC film for upholstery, flooring, etc. Of special interest were some boats and a car body, made in Australia from glass fiber-reinforced resin. In this connection, it may be mentioned that a plastic-bodied sports car prototype was shown at the 1955 Automobile Show, also held in Sydney.

Marine Exhibition in Paris

If there was one thing made clear by the 1955 Marine Show recently held in Paris, it was that initial difficulties in the use of reinforced polyester resins in construction of car bodies and boats have proved a stimulus to greater effort, rather than a deterrent. Different types of small boats made with glass fiber-reinforced polyesters were shown ranging in length from about 7½-11¾ feet, and weighing from 50-260 pounds. There were sailboats, skiffs, boats with outboard motors, and dinghies, including a new streamlined sports model for use in water skiing and supplied with a powerful outboard motor. A different kind of craft was a small ship's launch made of a sandwich material consisting of two layers of reinforced polyester resin and foamed plastic core. Another type featured a superstructure of laminated melamine resin.

Large crowds were attracted to two demonstrations of the use of polyester resins in the construction of boats: the first involved the production of a hull about 23 feet long and a little over seven feet wide; and in the second, an old wooden boat was renovated by being clad with a glass fiber-reinforced polyester resin. This boat was scraped to the bare wood, dried, repaired, and the surface planed to make it as smooth as possible. A first coat of polyester resin then was applied, over which a glass-fiber bat was spread, clamped to the boat, rubbed over to insure proper adhesion to the resin coat, and a polyester resin was sprayed on with a gun. After gelification of the resin, (which took about 10 minutes) and drying, the surface was pumiced smooth, and the entire boat, inside and outside, was enameled with a polyurethane resin.

At other exhibits could be seen such applications of reinforced polyester resin as porthole frames, casings, fish tanks, pipe, and the like; terylene sails, said to be superior to those of nylon; and lifeboat buoyancy tanks made of foamed plastic.

Electrostatic Filters

The electrostatic properties of rigid PVC have been utilized by a French firm, Manufacture d'Isolants et Objets Moules de la Compagnie Generale d'Electricite, to produce a wide variety of air filters for use in automobiles, tractors, electric locomotives, factories, and in ship-building.

Square and cylindrical filters are made from layers of rigid PVC sheet which is perforated, corrugated, and put together in such a way as to form innumerable little channels. The perforations are round with a diameter of 1-2 mm., and from 10-25 layers of the material are used to build up the square filters. The accumulations of dust and other impurities from the air that have settled in the filters are easily removed by simply soaking in a bath of gasoline, soapy water, or solution of some detergent for a few minutes. After drying, the filter is ready to be reused. The "Microfiltre," as it is called, is said to be gaining in popularity as a result of its efficiency.

"Injection-Forcing" Machine

Etablissements Sefom, in France, has developed an "injection-forcing" machine for injecting and forcing a plastic like PVC into the interior of a mold at low-pressure and high speed. At present, W 700, as the machine is called, is used only in the production of plastic footwear where it permits a process eliminating the need for separate assembly of soles and uppers. As such, the output of even complicated footwear models is said to be at the rate of two pairs a minute. All-plastic footwear, including even very fanciful styles with high heels can be made, as well as slippers and similar footwear, having plastic soles firmly anchored to felt, cloth, or leather uppers. While the plastic penetrates the

interstices of the fabric to give immediate adhesion, leather surfaces must first be roughened lightly to permit the plastic to penetrate.

The machine consists essentially of a screw plasticizing unit and a mold holder with 10 stations. It plasticizes 100 kilograms of material in an hour, and maximum injection is 1.5 kg. The low-pitch screw turns at high speed, and can be run in reverse to permit cleaning without the need for dismantling. The mold holder with vertical axis, is a circular horizontal table two meters in diameter; moves as a whole in the direction of the axis of the screw; and is operated by a hand lever. Since the maximum pressure on the material is 100 kg./sq. cm., molds of aluminum or Zamak may be used and cooling takes place in air.

This particular model has been designed to use PVC in granular form, but the company also builds a machine suitable for vinyl plastisols. While the machine is made for footwear only, it is planned to adapt it for making larger parts as well, both from polyethylene and PVC.

Australian Monsanto to Build

Monsanto Chemicals (Australia), Ltd., will erect a research building to cost L.80,000, at its main plant at West Footscray, Victoria. It is further learned that the company has acquired from Scott Bader & Co., Ltd., Wollaston, Northamptonshire, England, the sole rights for the manufacture and sale of their polyester resin in Australia, and a production plant has been installed at Monsanto's Melbourne Works.

German Petrochemical Plant

A little over two years after it was formed, the Rheinische Olefinwerke, G.m.b.H., Wesseling, in the Cologne district of Germany, began operations at the end of September as the first major German petrochemical concern. A joint enterprise of Badische Anilin und Soda Fabrik (B.A.S.F.) A.G., Ludwigshafen, and Deutsche Shell A.G., Hamburg, Rheinische, was formed in August 1953 with a capital originally fixed at 16,000,000 DM, but later raised to 30,000,000 DM. The project, as planned, requires about 70,000,000 DM, and embraces the manufacture of polyethylene from refinery gases supplied by Deutsche Shell. Initial output is expected to include 10,000 tons of polyethylene and up to 12,000 tons of ethylene benzene annually.

The B.A.S.F. already has been manufacturing polyethylene for some time, using a high-pressure polymerization process for its Lupolen H. Apparently, this process also is to be used at Rheinische, and the product is to be marketed under the same brand name, Lupolen H, by the B.A.S.F. The latter concern will take the ethylene benzene output for the manufacture of polystyrene.

Bofors to Make Plastics

One of Sweden's leading industrial concerns, A/B Bofors, Bofors, Karlskoga, originally active mainly in the metallurgical field, is to become an important manufacturer of plastics. The company started by establishing, through its affiliate, the A/B Bofors Nobelkurt, a small plastics factory in Tidaholm. This factory now is to be considerably expanded for the production of vinyl and styrene plastics, as well as glass fiber-reinforced plastics. This project will be carried out in close collaboration with A/B Malmo Flyingindustrie, of Malmo, which has a good deal of experience with glass fiber-reinforced polyester resins through its activities on behalf of the Swedish airplane industry. The affiliate of this concern, A/B Victory Produkter, also of Malmo, is one of the pioneers in glass-reinforced plastics.

Incidentally, several other important Swedish industrial concerns are becoming actively interested in plastics.

Plastics in Supersonic Planes

The use of plastics in the construction of aircraft to withstand the high temperatures generated at supersonic speeds was one of the subjects discussed at an "off the record" conference in Harrogate, Yorkshire, England, in November. The conference was the second to be held by the British Plastics Federation to discuss the use of plastics reinforced with glass or asbestos fiber, and was attended by representatives of government agencies and 48 manufacturing companies.

Temperatures on the outer skin of a supersonic aircraft run into hundreds of degrees centigrade, according to H. A. Collinson, conference chairman, and progress in reinforced plastics indicates that they present a real challenge to metals in this field. The temperatures withstood by reinforced plastic piping for handling chemicals, such as hot oil and sulfuric acid, were discussed. Samples of glass-reinforced epoxy piping were shown which remained undistorted at 300° C., and were still serviceable at 400° C.

Plans Philippine Urea Plant

Plans for the construction of a synthetic resin manufacturing plant in the Philippine Islands have been announced by the chemical division of Borden Co., New York, N. Y. Designed to meet the adhesive needs of the country's plywood industry, the plant will be the first such facility built in the Islands.

Borden's operation, to be located in Manila, will be incorporated as the Casco Chemical Co. Philippine investors will participate in its capitalization. The industry which it will serve is presently dependent on shipments from the United States, a large portion of which is shipped from Borden's plant in Bainbridge, N. Y.

Initial production is geared for eight-million pounds of urea resin per year. This should overcome the major drawback presently encountered; namely, limited storage life.

In Brief . . .

The Association of Austrian Industrialists has announced that per capita consumption of plastics in that country has almost doubled within three years, increasing from 0.7 to 1.2 kgs. Greatly expanded production has resulted in price reductions up to 20%, as shown by 1954 figures.

Farbenfabriken Bayer A.G., Leverkusen, by agreement with the **Casella Farbwerke Mainkur A.G.,** Frankfurt, is to undertake the large-scale production of the synthetic fiber known as Pan, developed by the Casella company.

Badische Anilin & Soda-Fabrik, Ludwigshafen, and the **Gelsenkirchen Bergwerks A.G.** have jointly set up a new phthalic acid plant having an annual capacity of 12,000 tons. The latter company will supply naphthalene as the new material, and phthalic acid anhydride is to be produced for the manufacture of synthetic resins and plasticizers.

Manufactures de Glaces et Produits Chimiques de Saint-Gobain Chauny & Cirey, and **Resines et Vernis Artificiels,** both of Paris, France, have obtained licenses to manufacture and sell Ciba's melamine-based products, covered in France by patent No. 811,904. The first-named company will manufacture all the melamine-based materials, whereas the second will supply molding powders.

The Kunstzijdespinnerij, Nyma N. V., of Nijmegen, Netherlands, whose chief products are rayon yarns and tire cord, has recently begun to manufacture Nymerlon, a polyacrylonitrile fiber like Orlon. The monomer is imported and polymerized by a process developed in the company's own laboratory. The process is claimed to yield a product with the same good properties as Orlon and, in addition, is said to be almost wholly free of the tendency to "pilling" noted in other synthetic fibers, particularly Dacron and nylon.

Algemeene Kunstzijde Unie N. V. has started the manufacture of terylene, to be marketed as Terlenka, at its Terlenka Factory, Emmen, Netherlands.

N. V. Hollandsche Draad-en Kabelfabriek, Amsterdam, Netherlands, has begun the manufacture of plastic pipe in its new West Berlin company. The choice for the location of the new enterprise fell on West Berlin because of the fiscal concessions obtainable there, and also because the company could be accommodated at the local subsidiary, Kabelwerk Reinshagen, G.m.b.H.

NAMES in the NEWS

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has announced the following personnel changes within the polychemicals division:

John H. Daughtridge and **Russell C. Wiegel,** previously assistant sales directors, become directors of sales for the department; the former directing industrial chemical sales and technical service, and the latter performing the same function for the plastics end.

Arthur M. Cole as assistant sales director for industrial chemicals.

Jerry D. Shaw as assistant to **Mr. Wiegel,** covering Teflon, Tynex, Butacite, and Plastacele.

C. D. Bell also as assistant to **Mr. Wiegel,** covering Lucite, Zytel, and Alathon.

Frank G. Keenen as product manager for ammonia and related products.

Robert R. Warner as product manager for methanol and other chemicals.

Richard D. Scheer as manager of industrial chemical sales.

William S. Robertson as assistant manager of industrial chemical sales.

T. A. Parriot as manager of Zerone and Zerex sales.

Francis M. Jornlin as manager of nitrogen product sales.

F. E. Wintzer as marketing manager of Butacite polyvinyl butyral resin.

William W. Beck as manager of sales training and personnel.

William A. Franta as marketing manager for Teflon.

Albert A. Pavlic as plastic resin sales manager.

Henry M. Cadot as product manager for Zytel nylon resin.

Herbert S. Lecky as product manager for Alathon polyethylene.

Raymond E. Brady as product manager of Lucite.

William E. Grigsby as manager of sales technical service.

Doyce B. Hanson as director of the department's sales service laboratory.

Russell B. Akin as assistant manager of sales technical service.

Milton J. Roedel as manager of the end use development section.

R. Jack Manning as marketing manager for Tynex, Pyralin, and Plastacele.

David L. Messenger will represent the Durite department of Borden Co.'s chemical division in upper New York State and western Pennsylvania. The Durite line includes phenolic molding compounds, resins for abrasive and friction bonding, and lamp basing cements.

Carl Halpin has joined Lunn Laminates, Inc., Huntington Station, N. Y., as a sales engineering representative in the Detroit, Mich., area, working on the development of reinforced plastics applications in the automotive, electrical, and associated industries. A registered engineer, **Mr. Halpin** has been associated with Fisher Body Div. of General Motors Corp.; Fruehauf Trailer Co.; Baker Perkins, Inc.; F. L. Jacobs Co.; and Carl Halpin Industrial Engineers.

D. B. Benedict has been appointed a vice president of Carbide & Carbon Chemicals Co. Formerly the firm's works manager, he will be responsible for long range planning in certain research and development activities, as well as all programs on synthetic fibers. **Gordon Ault,** former technical representative, becomes assistant manager of the San Francisco district in another appointment.

Richard D. Mace

Richard N. Comes

Richard N. Comes has been appointed manager of Banbury mixer sales for Farrel-Birmingham Co., Inc., Ansonia, Conn. He is succeeded as field sales engineer in New England by **Richard D. Mace,** who has been assistant superintendent of foundries since 1953.

Edward J. Sheridan has been elected vice president in charge of production for A. Bamberger Corp. and its wholly-owned subsidiary, American Molding Powder & Chemical Corp., both in Brooklyn, N. Y. He was formerly chief chemist of the R-B-H Division of Interchemical Corp., and later general manager of the pigments division, Sun Chemical Corp.

Herbert R. Helbig has been named general manager of Reichhold Chemicals' export division, White Plains, N. Y. Product sales manager since 1954, he previously managed the firm's central Atlantic division.

Edmond S. Bauer

Thomas W. Sears

Edmond S. Bauer has been named assistant director of sales for resin products, and **Thomas W. Sears** has become sales manager for industrial resins, Monsanto Chemical Co.'s plastics division, Springfield, Mass. Formerly sales manager of industrial resins, **Mr. Bauer** will be responsible for the sale of industrial, textile, and paper resins. **Mr. Sears** previously was assistant sales manager for industrial resins, and will report to **Mr. Bauer** in his new assignment.

Albert Spaak has joined Mastro Plastics Corp., Bronx, N. Y., as chief engineer. He was formerly associated with De Mattia Machine & Tool Co., Clifton, N. J.

Colin Holstead has been appointed specialist in resin development for the chemical materials section of Canadian General Electric Co., Toronto, Ont. **Dr. Holstead** has been assigned to C.G.E.'s Davenport Works in Toronto.

W. C. Douce, J. T. Roach, R. G. Askew, and **C. R. Scott** have been appointed district managers for plastics sales offices in New York, Chicago, Los Angeles, and Boston, respectively, which will be established next spring by Phillips Chemical Co. **W. R. Barrett** and **G. F. Blinzler** will become sales engineers for the Boston and Chicago district offices. **M. W. Davidson** has been named supervisor of the sales service and development branch in Bartlesville, Okla., and **L. B. Croley, J. V. Smith,** and **A. L. Walters** will be assigned there as sales service engineers.

Robert A. Gerardi, formerly of Grumman Aircraft Corp., has joined Durable Formed Products, Inc., New York, N. Y., as vice president in charge of contracts administration. In this position, he will provide liaison between the sales and production departments.

Paul G. Langevin has been appointed advertising manager of Gering Products, Inc., Kenilworth, N. J., manufacturers of garden hose, sprinklers, and other plastic products. He previously served with Bolta Products.

Willis M. Cooper has been appointed assistant general manager of Monsanto Chemical Co.'s research and engineering division, St. Louis, Mo. He previously served as director of engineering for the division.

William J. Fath

William J. Fath has been appointed production control manager of Hydraulic Press Mfg. Co., Mount Gilead, O. He was formerly production and plant manager for National Farm Machinery and Fruehauf Trailer Co.

G. K. McDonald has been appointed assistant to the chemical division's production manager at Koppers Co., Inc., Pittsburgh, Pa. Formerly manager of the Seaboard plant in Kearney, N. J., Mr. McDonald is succeeded by W. K. Todd who also is manager of the Chemaco plant in Berkeley Heights, N. J.

J. L. Lane has been named assistant general manager of Visking Corp.'s international division, with headquarters in Chicago, Ill. This division deals with all of the firm's products, including Visqueen polyethylene film.

K. O. William Sandberg

K. O. William Sandberg has been named manager of General Electric Plastics Department's custom molding plant in Decatur, Ill. He previously served as operations research manager and as engineering manager for the department.

William E. Stubbins

William E. Stubbins has been named New England representative for Van Vlaanderen Machine Co., Paterson, N. J. He will make his office at 211 W. Exchange St., Providence, R. I.

Francis E. Weisend

Francis E. Weisend has been named plant manager of B. F. Goodrich Co. Plastics Products Division's plant in Marietta, Ohio. He is being replaced as plant engineer by **E. Wilbur Johnson. Mr. Weisend** joined Goodrich in 1938, and has served as physical testing laboratory engineer, power engineer at the company's Oaks, Pa., tire plant, and as plant engineer at Marietta. **Mr. Johnson** joined Goodrich in 1951 as a design engineer, after previous association with International Derrick & Equipment Co., and Marietta Concrete Corp.

Robert B. Mesrobian

Robert B. Mesrobian, consultant to the nuclear engineering division at Brookhaven National Laboratory, Long Island, N. Y., has been advanced from associate to full professor of polymer chemistry at the Polytechnic Institute of Brooklyn, N. Y. Dr. Mesrobian also becomes associate director of Polytechnic's Institute of Polymer Research.

Alvin M. Weinberg has been named director of Oak Ridge National Laboratory, according to an announcement by C. E. Center, vice president of Union Carbide Nuclear Co., a division of Union Carbide & Carbon Corp., New York, N. Y. Dr. Weinberg was formerly research director at the Laboratory.

Lawrence E. Nielsen, a physical chemist in Monsanto Chemical Co.'s Springfield, Mass., research laboratories since 1945, has been named a senior scientist for the company. Created to allow capable scientific personnel to progress within the firm without having to engage in administrative activities, the senior scientist position offers maximum freedom in planning and carrying out research and acting as a consultant to all divisions of the company. As a physical chemist, **Mr. Nielsen** initiated and guided a broad research program dealing with the mechanical properties of polymers and their relationship to molecular structure.

Studio New York Times

Virgil W. McDaniel

Virgil W. McDaniel has been named division president of Interchemical Corp.'s Cotan Division, Newark, N. J. He succeeds **C. T. Melvin** who is retiring from active management, but who will continue in a consulting capacity. **Robert L. Lewis,** Cotan vice president, has been given greater responsibilities in production work; **Russell F. Tandy** will head a newly-constituted development department; and **John Kuser** has been appointed assistant sales manager. **Mr. McDaniel** joined Cotan as vice president last year after 15 years with Interchemical's finishes division.

William J. Canavan

William J. Canavan has been named assistant manager of the extrusion materials division, Bakelite Co., New York, N. Y. He joined Bakelite in 1944 as a technical representative in the wire and cable materials division; was transferred in 1951 to the new product engineering department as a development engineer on extrusion materials; and early in 1955 was appointed assistant to the works manager in the manufacturing department.

Webb Photos

Roger B. Knowles

Roger B. Knowles has been appointed general manager of the reinforced plastics division, Bigelow Sanford Carpet Co., Inc., New York, N. Y.

Howard L. Smith has been appointed sales manager for the chemical division of Belding Corticelli Industries, New York, N. Y. Initially, he directs sales of BCI nylon, and eventually all of the firm's plastic products. Mr. Smith previously served as managing director of Colloids of Canada, Ltd.

D. L. Matthews

D. L. Matthews has been appointed chief engineer of Goodrich-Gulf Chemicals, Inc., Cleveland, O. He previously served as manager of B. F. Goodrich Chemical Co.'s plant at Avon Lake, O.

William J. Woodruff has been appointed sales manager of Tech-Art Plastics Co., Morristown, N. J. Formerly general manager of T. M. James Co., a division of Stewart Hartshorn Co., Mr. Woodruff has been with Tech-Art for the past year.

Hugh S. Ferguson

Hugh S. Ferguson, president of Dewey & Almy Chemical Co. division of W. R. Grace & Co., New York, N. Y., has been named executive vice president of Grace in charge of the chemical group. **Alexander T. Daignault** was elected executive vice president and chief financial officer of Grace, and six other men have been promoted: **Allan S. Rupley,** former head of the financial services group, and **Andrew B. Shea,** former executive vice president in charge of South and Central American operations, have been given new corporate responsibilities; **James H. Stebbins,** assisted by **John T. Whitely,** succeeds **Mr. Shea; Lucas A. Alden** moves up to replace **Mr. Stebbins** as vice president in charge of industrial and marketing service for the South American group; and **Fred R. Feuss,** former assistant vice president and assistant treasurer, succeeds **Mr. Alden** as comptroller.

Owen F. Beckmeyer, Vert C. Fraser, and **Richard W. McKay** have been named plant manager, production manager, and technical manager of the Avon Lake general chemicals plant of B. F. Goodrich Chemical Co., Cleveland, O.

Ted Barks has been appointed plant manager of The Pantasote Co., Passaic, N. J. He was formerly with Monsanto Chemical Co.

Gordon Cook

Gordon Cook has joined Columbian Carbon Co., New York, N. Y., as general manager of colloidal dispersions. He will be in charge of production of dispersions of carbon black in aqueous media and other suitable vehicles for use in plastics, paints, and coatings. **Mr. Cook** comes to Columbian Carbon from Acheson Industries, Inc., where he was sales manager since 1952. Previously, he was with Peerless Printing Ink Co. from 1948 until its merger with Acheson in 1951, and with Sherwin-Williams Co. for 20 years.

Fred Hillsey

S. H. Greenwood

Samuel H. Greenwood has been promoted to field sales manager for F. J. Stokes Machine Co., Philadelphia, Pa. In his new position, **Mr. Greenwood** will direct all of the firm's sales activities in the United States and Canada, and will supervise the operations of the 10 Stokes district offices. With the company since 1949, he first served as manager of plastics extruder sales, and was named Philadelphia district manager in 1953. **Fred Hillsley** will succeed **Mr. Greenwood** as manager of the Philadelphia district. **Mr. Hillsley** has served with Continental Mills, the Frankford Arsenal, and Corning Glass Works, joining Stokes in 1953 as a sales engineer.

Hans Wyman

Hans Wyman has been elected president of the Eleonora Chemical Corp., a newly-formed subsidiary of The Pantasote Co., Passaic, N. J., and New York, N. Y. Eleonora will produce PVC used by Pantasote for the manufacture of coating fabrics, film, and sheeting. The new plant of Eleonora is scheduled for completion before the end of 1956.

Frank Sherry

Frank Sherry has been named manager of Seiberling Rubber Co.'s plastics division plant in Newcomerstown, O., succeeding **C. F. Biggs,** who returns to the company's main factory in Akron on special assignment. **Mr. Sherry** had been serving as a plastics production manager for B. F. Goodrich Co.

Three appointments to the technical service staff of its Glendale Plaskon Laboratory in Toledo, O., have been announced by Barrett Division, Allied Chemical & Dye Corp., New York, N. Y. **Donald C. Davis** has joined the coating resins group to assist in developing products for the paint, varnish, and lacquer trade; and **John G. Mohr** and **Carl A. Marszewski** have joined the polyester resins staff on laboratory and field development work. A graduate of the University of Toledo, **Mr. Davis** has nine years of paint formulation experience with American Marietta Co. and Du Pont's Finishes Division. **Mr. Mohr** has been active in glass technology for 12 years, principally with Libbey-Owens-Ford Glass Co. **Mr. Marszewski** previously was with Barrett's coating resin plant, and has had industrial experience with Bakelite Co. and U. S. Industrial Chemicals Co.

Joshua S. Miller

Joshua S. Miller has been appointed to the newly created post of automotive sales manager for Monsanto Chemical Co.'s plastics division, Springfield, Mass. Mr. Miller had been assistant product sales manager for Resinox thermosetting molding materials since 1953.

Richard Neagle, industrial designer and head of Richard Neagle Associates, has been retained by the plastics division, Monsanto Chemical Co., Springfield, Mass., as a consultant. He will aid in the development of plastic products for various industries by conducting experiments to explore the esthetic and functional capabilities of plastics.

New Materials

Fire-Resistant Epoxy Hardener

Het Anhydride, a new chemical developed by Hooker Electrochemical Co., is said to offer two properties previously not found together in epoxy resin curing agents; namely, fire resistance and high temperature strength. The material is used in approximately equal proportions with the resin and, being cheaper in price, offers substantial savings.

Good electrical properties, retained at high operating temperatures, are claimed for the chemical. Castings, printed circuits, laminates, and other electrical equipment can be used at higher temperatures and under more severe conditions than previously, it is reported, without heat distortion or danger of fire. Het Anhydride is expected to find many applications in the tooling industry, where the manufacture of metal- and plastic-forming dies requires high heat resistance.

Tentative specifications are listed as follows:

Molecular weight	370.85
Chlorine content, %	57.4
Melting point, °C.	239-240
Minimum purity, %	99
Density @ 25°C., gm./cu.cm.	1.73
Bulk density, gm./cu.cm.	0.96
Acid number, mg.KOH/gm.	303

Het Anhydride will undergo chemical reactions typical of phthalic anhydride, and will react readily with alcohols to form an acid-ester compound. Hydrolysis to Het acid will take place on exposure to the atmosphere, therefore care should be taken to keep containers closed tightly at all times. No dermatological effects have been observed, however normal precautions for handling a new chemical should be observed. The material is supplied in five- and 30-gallon steel containers weighing 40 and 250 pounds, respectively.

Readers' Service Item M-1

Ultra-Fine Color Dispersions

A line of ultra-fine color pigment dispersions in paste form has been introduced by Acheson Dispersed Pigments Co. under the designation, 0100 Series. While the industry, in general, considers a 2% variation in color as being satisfactory, the new series reportedly gives an exact match in masstone, undertone, and tinting strength.

Tinting strength is checked by two methods: reducing with an opaque white, and in the dispersion vehicle. Reductions approximate 100 to one, and must check with the standard. N.P.I.R.I.'s Fineness Gage is used to check particle size, and is reported to be more sensitive than the North and Hegeman gages used throughout the paint industry. Maximum particle size is 0.25 mil, and weights per gallon vary from 9.3-20.4 pounds, depending on the individual pigment.

Fineness of dispersion is said to result in savings of equipment time and eliminate a large part of off-color scrap. Once the formula is set up for the calender or extruder, ADP guarantees subsequent color batches for identical match. The pastes are stabilized against agglomeration, eliminating streaks and tails.

Readers' Service Item M-2

Four Marvinol PVC Resins

Four new polyvinyl chloride resins, Marvinols VR-24, MX-1101, MX-2205, and MX-2206, are currently being marketed by Naugatuck Chemical, division of United States Rubber Co. Property data is reported as follows:

Marvinol VR-24 features low molecular weight, high bulk density, heat stability, and color retention. Easily processed and requiring little stabilization, the material can be used with other resins to reduce processing temperatures while maintaining their physical properties. VR-24 is also reported to be superior to most PVC resins in electrical insulation applications requiring high volume resistivity.

Plasticized film and sheeting can be obtained at low (300-320° F.) temperatures on the calender rolls, and adhesion to cloth is particularly good. The resin can be extruded at temperatures 20-30° F. lower than high molecular weight resins in flexible and semi-rigid formulas. Better flow characteristics offer advantages in injection molding.

Marvinol MX-1101 is characterized by small particle size and the advantages it offers in rigid applications. Particularly suited for fast open-mill mixing and short Banbury cycles, the material is easily processed in unplasticized formulas. Extrusions are smooth, and can be formulated to give high impact strength. Injection molding can be accomplished at low pressures and temperatures using standard equipment.

Marvinol MX-2205 was developed specifically for the calendering industry, where it offers good dry-blending qualities, fast processing, no color drift, high gloss, brilliance, and clarity. Intermediate molecular weight and high bulk density make possible larger Banbury loadings and increase calender out-put. MX-2205 can be extruded from either dry-blends or granules, and factory experience shows that it can be used commercially for injection molding.

Marvinol MX-2206 reportedly has the lowest molecular weight of any commercially available PVC, and is designed for rigid applications. High heat stability and ease of processing make it particularly suitable for calendering and injection molding in unplasticized formulations. Processing temperatures are 10-20° F. lower than those for any other PVC. MX-2206 should also be of interest in solution work due to the low viscosities and high solids which are obtainable.

Resin and compound properties for these materials are reported as follows:

	VR-24	*MX-1101*	*MX-2205*	*MX-2206*
Specific viscosity	0.3	0.32	0.37	0.25
Average apparent density, lb./cu. ft.	33	23	32	34
Particle size, microns	25	8	33	24
Acetone solubility %	51	37	40	55
Hardness, Shore A	77	—	78	—
Ultimate tensile strength, psi	2,200	7,350	2,600	7,460
Ultimate elongation, %	270	—	360	—
100% modulus, psi	1,300	—	1,300	—
Tear strength, lbs/in.	370	—	430	—
Impact strength, Izod, ft.-lbs	—	0.8	—	0.45
Hardness, Rockwell R	—	115	—	116
Heat distortion @ 264 psi., °C	—	76	—	75

Readers' Service Item M-3

Nitrocellulose Plasticizer

An octyl-butyl-phthalate plasticizer, reportedly superior to dibutyl phthalate in imparting permanence, heat sealability, and cold check resistance to nitrocellulose lacquers, has been developed by Eastman Chemical Products, Inc. Designated Plasticizer 84, the material also offers low temperature flexibility, print resistance, blocking resistance, and hardness.

Incorporated into a typical wood finish lacquer, the formulation showed a single long check through the ninth cycle, when dried and subjected to 25 cold check cycles. Films containing Plasticizer 84 sealed at lower temperatures than those containing dibutyl phthalate and tricresyl phosphate. They also showed a sharper melting point (140-200° F.), indicating increased blocking resistance.

Tests for tensile strength and elongation show the material to be superior to dibutyl phthalate in the former respect, though not as good as in the latter. There was no discernible exudation on any of the films tested at 250° F. when checked at 24-, 48-, 72-, and 144-hour periods. Films containing the new material showed less plasticizer loss on heating than did those containing dibutyl phthalate.

Readers Service Item M-4

New Materials (Cont'd.)

High Dielectric Plastic Foam

A series of plastic foam materials featuring high dielectric constant and low weight have been introduced by Emerson & Cuming, Inc. Called Eccofoam Hi K, the materials find application as radome cores, micro wave lenses, and in waveguides and antennas.

Eccofoam Hi K has an extremely low dissipation factor, and is useable over a temperature range from —65 to +275°F. The relationship between bulk density and dielectric constant can be varied somewhat. A material having a dielectric constant of 2.5 has been made with a density as low as six pounds per cubic foot.

Maximum recommended service temperature is 150°C., with strength falling off beyond this figure. Being unicellular, the foam is unaffected by high humidities. Fabrication is straightforward, requiring only standard tools. Eccofoam is supplied as sheet stock, and can be cemented readily with Eccopaste E.

Readers' Service Item M-5

Primary Vinyl Plasticizer

A new generic type of general-purpose primary plasticizer for PVC resins has been introduced by the industrial oil department of Swift & Co. Called Esterflex B-1, the material is said to evidence high solvating properties, and can be used in all types of processing.

Ready absorption in dry blending operations is reported, with subsequent reduction in blending time. Inherent stability permits the use of high processing temperatures to obtain better physical properties. Heat-seal is obtained at relatively low temperatures, and static build-up is minimized. Physical properties are reported as follows:

Pour point, °F	30
Gel point, °F	5
Flash point, open cup, °F	405
Fire point, open cup, °F	450
Refractive index @ 25°C	1.5029
Color, Gardner	2-4
Viscosity @ 27° C., cps	131
Acidity as acetic acid, %	0.1
Ester content, %	99
Specific gravity @ 25° C	1.04
Weight, lbs./gal	8.704

Performance data in a semi-rigid formulation of five-mil film shows a tensile strength of 9,100 psi., and an elongation of 11%. Esterflex B-1 is shipped in 55-gallon non-returnable drums, and in 4,000-, 6,000-, and 8,000-gallon tankcars.

Readers' Service Item M-6

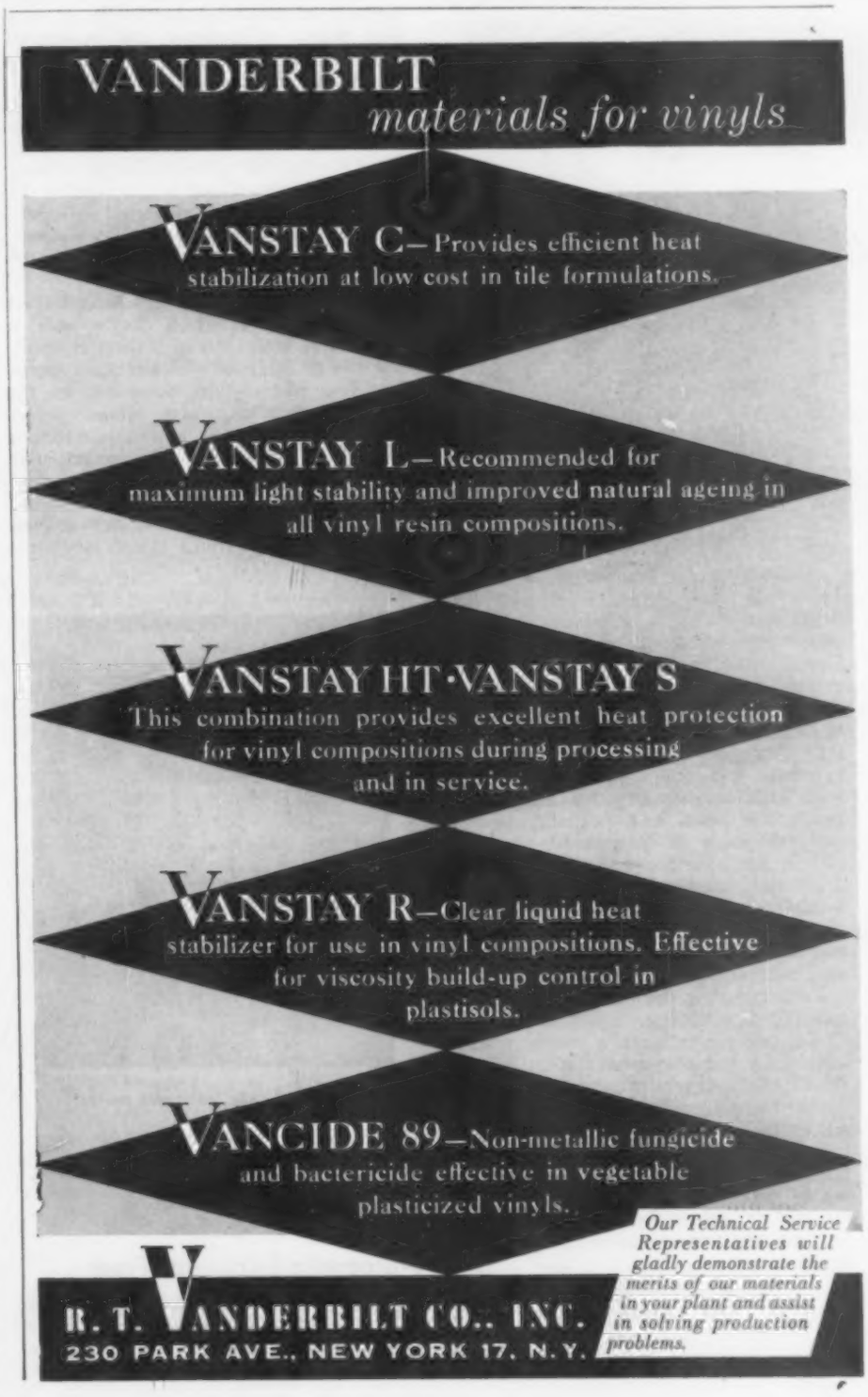
Secondary Vinyl Plasticizer

A plasticizer reportedly designed for vinyl formulations requiring high temperature processing cycles or low temperature flexibility has been introduced by Pittsburgh Coke & Chemical Co. A diiso-decyl adipate offering low specific gravity and volatility as well as high permanence characteristics, PX-220 is available in drum and tank car quantities.

The material is commonly used in combination with other plasticizers for producing upholstery stocks, garden hose, tubing, gasketing, and electrical insulation. Vinyl dispersions containing moderate amounts of PX-220 exhibit low initial viscosities and good viscosity stability. The material is compatible with nitrocellulose, ethyl cellulose, butyrate, and most synthetic rubbers. Following are the specifications reported for this plasticizer:

Specific gravity	0.915-0.919
Color, A.P.H.A.	50
Acidity as acetic acid, % max.	0.01
Ester content, % min.	99
Moisture, %	0.1
Ash, %	0.001
Odor	Mild
Molecular weight	426.7
Boiling point, °C.	241
Freezing point, °C.	—71
Flash point, °F.	425
Viscosity @ 25°C., cps.	30
Refractive index	1.45
Weight, lbs./gal.	7.6

Readers' Service Item M-7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materials for vinyls
VANSTAY C—Provides efficient heat stabilization at low cost in tile formulations.
VANSTAY L—Recommended for maximum light stability and improved natural ageing in all vinyl resin compositions.
VANSTAY HT·VANSTAY S
This combination provides excellent heat protection for vinyl compositions during processing and in service.
VANSTAY R—Clear liquid heat stabilizer for use in vinyl compositions. Effective for viscosity build-up control in plastisols.
VANCIDE 89—Non-metallic fungicide and bactericide effective in vegetable plasticized vinyls.
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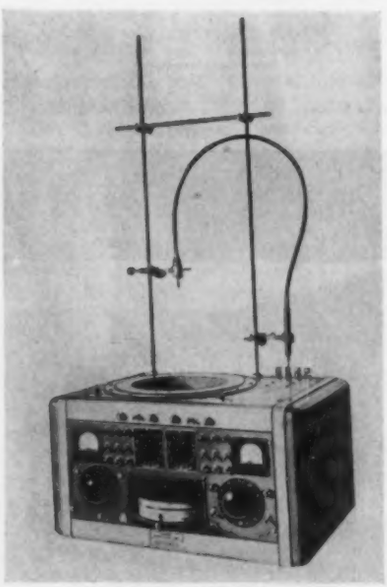
230 PARK AVE., NEW YORK 17, N.Y.

New Equipment



Multi-purpose Castor Process Unit

Castor Polymer Process Unit

A multi-purpose instrument, which can be set up for a variety of controlled organic reactions by suitable selection of glassware, has been announced by Burrell Corp., exclusive distributors of the Castor equipment line. Known as the Castor Process Unit, the instrument is reported to be particularly suitable for high polymer resin processing and polymerizations.

Process perimeters can be determined with sufficient accuracy for adoption in production units, and flexibility permits the processing of polyesters, phenolics, alkyds, and silicones with a minimum of time and attention. Operation is both manual and timer-controlled. Stirrer motor, pyrometer controller, thermocouple, and mantle temperature indicator may be used with adjacent apparatus.

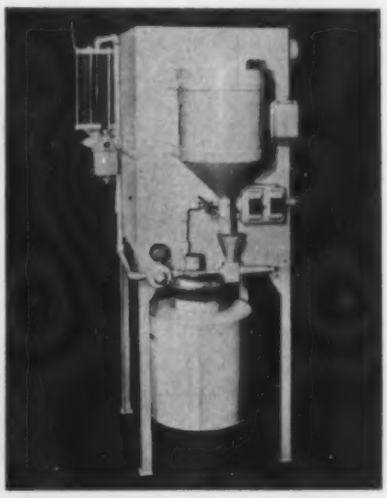
Parts include a five-liter heating mantle, a 0-300° C. pyrometer controller, a 0-500° C. indicating pyrometer, a mantle voltage control, a variable-speed (40-210 rpm.) flexible-shaft stirrer, two 24-hour interval timers, two solenoid valves (200 psi. max.), an enameled steel cabinet, and support rods. The instrument simplifies the compounding of sample batches and the charting of process formulas. Advantages are reported to include time and cost savings, raw material conservation, and product improvement.

Readers' Service Item E-1

Powder Dispersing and Confining Machine

Equipment for the dispersal and confinement of powdered material in air, in a high degree of fineness and in desired density, precluding the possibility of plant atmosphere contamination and accompanying health and fire hazards, has been developed by and is available from Craig Corp. The device is said to be valuable to such industrial processes as the dusting of rubber, plastics, and coated fabrics; the blending of several dry powdered materials, such as powdered resins; and other manufacturing operations requiring the use of powdered materials.

The device is compartmentalized, one or more chambers of which can be used to dust one or both sides of a sheet material, and may be equipped with electronic means for dust precipitation, according to the company. Brushes, drags, wipes, and/or hot or cold calendering, and squeeze rollers, either inside or outside the chamber, may also be employed, as well as a secondary heated chamber if the powdered material is to be softened or melted, such as with a wax or resin. Various models and sizes of the machine are available.



Model DI Craig Unit and collector

Readers' Service Item E-2

Automatic Decorator Press

A new series of automatic presses for silk-screen process printing of sheet materials has been introduced by General Research & Supply Co., to supplement its Series A decorator presses. Known as Series B, the machines will accommodate flexible sheets, warped or bowed stock, cloth, and other non-rigid and rigid materials.

Series B Decorator Press.

Basic elements include a reciprocating one-piece bed, a reciprocating stencil frame, and a stationary squeegee. The work is hand-registered to fixed guides which are fastened along the press bed. The sheets are held flat during the printing stroke by means of a vacuum which is exerted through holes in the bed. Controlled level impression and accurate register give clean, sharp printing and uniform quality.

Series B presses are particularly adaptable to the production of printed electronic circuits, but can be used for such widely diversified products as embossed book covers, ceramic tiles, and metal nameplates. They will lay down a heavy deposit of color, including metallic inks, and will do split fountain printing in several colors.

Three models are available, B1224, B1824, and B1836, for which the following specifications are reported:

	Model B1224	Model B1824	Model B1836
Maximum sheet size, in.	13 x 25	20 x 26	20 x 38
Maximum sheet thickness, std., in.	0.75	0.75	0.75
Minimum, in.	0.003	0.003	0.003
Design size, in.	12.5 x 24.5	19 x 25	19 x 37
Minimum gripper margin, in.	0.5	0.5	0.75
Speed range, in./min.	1.800	1.800	1.500
Over-all length, ft.	5	7	7
Width, ft.	4	4	5
Height, in.	42	42	42
Vacuum pump motor, hp.	0.5	1	1
Press drive motor, hp.	0.5	0.75	1

Readers' Service Item E-3

High-Speed Automatic Press

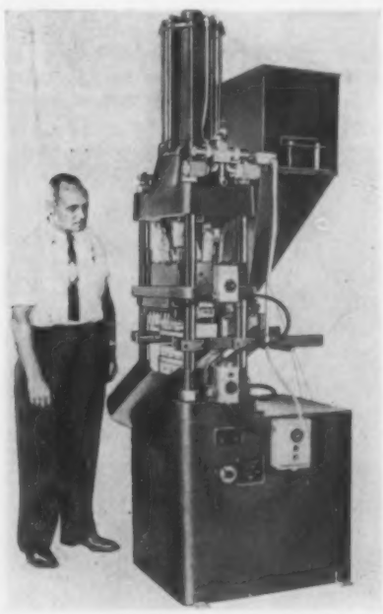
Two, fully-automatic compression molding machines capable of four-second cycling have been introduced by Automatic Molding Machine Co. Their designations, Automold A50 and A25, are based on their respective 50- and 25-ton capacities.

All moving parts are mechanically positive; the only electrical items being the mold heater, curing cycle timer, and safety switch. The feeding mechanism is cammed

into the opening and closing of the press. Telescoping tubes predetermine the correct charge, and the number of cavities is limited only by the over-all capacity. Cycling is continuous, and the only manual operations involve proper initial adjustment, occasional refilling, and removal of the finished thermoset.

A toggle arrangement slows the moving platen at the end of each stroke to allow for the escape of accumulating gases, and thus minimize shock and mold wear. Lifters placed on the core side provide for press ejection, and ejector pins strip the parts from the cores. Specifications for the two models are quoted as follows:

	A50	A25
Platen area, in.,	14 x 6	12 x 6
Stroke, in.	7.75	6.625
Ejection stroke	As reqd.	As reqd.
Distance between platens, max., in. (closed)	19	15
Minimum	15	13
Height, ft.	9	8
Floor space reqd., in.	30 x 32	30 x 30
Air requirements, psi	120	120
Volume, cu.ft./cycle	0.49	0.22



Automold Model A50 vertical press

Readers' Service Item E-4

Thermocouple-Type Test Nozzle

A new test nozzle designed according to the new SPI-General Motors specifications has been introduced by Injection Molders Supply Co. Intended primarily for rating injection machine capacity in ounces and in pounds per hour, it features an exposed thermocouple wire which is suspended in the hot plastic.

The nozzle can be used to check manufacturers' rating of heating cylinders and,

IMS thermocouple-type test nozzle.

by installing a ½- or ¾-inch radius removable nozzle tip, can be used in actual production. An external couple is provided to check the differential between nozzle and material temperature. Nozzles are available for all Stokes, IMS, and Reed-Prentice heaters using 1¾-8 inch nozzle threads, and are made to order for other type heating cylinders.

Readers' Service Item E-5

Sanitized Conveyor Pulley

A steel pulley completely enclosed in a 5/16-inch thick, specially - formulated, bonded plastic cover has been developed by Mercury Conveyor, Inc. Intended primarily for sanitary-type applications, the pulley has no exposed metal other than the stainless steel shaft. The pulley can be cleaned with steam or hot water, and its plastic cover is waterproof, non-toxic, and resistant to chemical attack. Cost is reported to be considerably lower than the stainless steel pulleys previously used.

Mercury conveyor pulley.

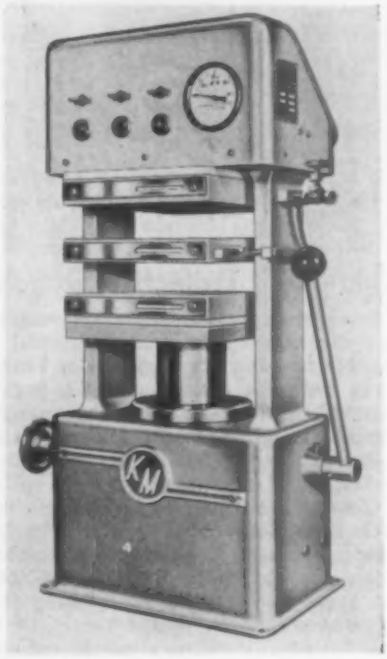
Readers' Service Item E-6

Two-Stage Hydraulic Press

A hydraulic press designed for laboratory use in testing, laminating, and rubber and plastic molding has been introduced by the hydraulic division of Kingsbacher-Murphy Co. Known as the KM-2, the machine features a two-stage hydraulic pump which develops up to 40,000 psi. pressure on the platens.

Upstroke is used for low pressure work and the ram is raised rapidly, whereas a slower downstroke is employed for high pressure work. Individual thermoswitches permit temperature control to 600° F. by means of cast-in electric heaters, which operate on either 110 or 220 volts A.C. or D.C. Cast-in steel coils can be used for water cooling or heating by oil, steam, or air.

The frame is of all-steel welded design, and a 10¾-inch horizontal clearance between the frames permits the use of extra large molds. KM-2 is available in two-, three, and four-platen models; the latter being used for laminating, and has heaters in the upper platens only. Other specifications are quoted as follows:



Kingsbacher-Murphy 20-ton hydraulic press.

Length of piston stroke, in.	4
Maximum platen opening, in.	8
With adapter	4
Maximum line pressure, psi.	3,200
Ram diameter, in.	4
Heat range, °F.	200-600
Depth of base, in.	11
Over-all depth, in.	20
Width of base, in.	16
Over-all width, in.	22
Height, in.	36
Platen size, minimum, in.	8x8
Maximum, in.	9x12
Weight, lbs.	350-455

Readers' Service Item E-7

New Products

Breakproof all-plastic goggles.

Lightweight Protective Goggles

Breakproof protective goggles weighing only one ounce have been introduced by General Scientific Equipment Co. Featuring a one-piece acetate lens, the goggles reportedly offer freedom from weight-induced eye fatigue, plus greater resistance to abrasion, sparks, flying chips, and spatter.

Clear or medium green lenses, 50 mils thick, fit tightly into sturdy plastic frames. Temples consist of plastic-covered cables which combine strength with flexibility. The goggles are suitable for wearing over prescription glasses, and are said to be ideal for wood working, grinding, and spot welding.

Readers' Service Item P-1

Reinforced plastic cover converts pick-up truck to panel model.

Molded Plastics Truck Cover

A new one-piece molded plastics cover that permits easy conversion of ½- or ¾-ton open-bed pick-up trucks to panel models has been introduced by Eastern Glas Laminates, Inc. Lightweight weatherproof, and rugged, the new cover can convert a truck to panel design in less than five minutes. Constructed of fiber glass-reinforced polyester resin made by Barrett Division, Allied Chemical & Dye Corp., the cover has high strength, excellent weathering and insulating properties, high resistance to sound and shock, and can be used in any climate or terrain.

The covers are available in several models: one has windows and a rear lift door; another is windowless and has no rear lift door; and the third is adapted to the needs of sportsmen and campers. This sports model has a built-in sliding floor which provides quick access to equipment and can be pulled out to make a table or work bench, and a specially installed across-the-bed shelf for bed rolls or air mattresses. The plastic covers can be spray-painted to match or contrast with the truck body, and will fit Chevrolet, Dodge, Ford, G.M.C., International, and Willys truck units.

Readers' Service Item P-2

Vinyl Markers for Traffic Lines

Repainting of faded traffic lines in streets is eliminated by a new marking system of vinyl plastic strips and markers called Nefslabs. Made by J. W. Neff Laboratories, Inc., in a variety of colors, the Nefslabs are compounded from B. F. Goodrich Chemical Co.'s Geon vinyl resin. The markers are tough, yet flexible, so that they do not become too brittle at sub-zero temperatures, nor too soft in the hottest weather. In addition, they resist the effects of water, gasoline, oil, and salts, and do not crack or chip from constant traffic pounding and the effects of weathering. The markers are colored throughout to always present a bright surface.

Nefglu adhesive, supplied with every order, eliminates the need for metal fasteners. The roadsurface is cleaned, adhesive applied, and the vinyl markers put down. Foot pressure or a hand roller on the Nefslabs securely fastens them to the pavement with the quick-setting glue. The

Nefslab vinyl plastic markers for traffic lines and road instructions.

markers are available in strips and individual marker sizes. Strips are made in 3-, 4-, and 6-inch wide rolls measuring 12½ feet in length.

Readers' Service Item P-3

Zytel nylon wire braider bobbins.

Nylon Braider Bobbins

A molded bobbin for braiding wire has been developed by Plastic Mold & Engineering Co., using Zytel nylon molding powder supplied by E. I. du Pont de Nemours & Co., Inc. Since the bobbins are injection molded, they are uniform in size. This fact, coupled with nylon's resiliency, is said to make possible accurate put-up at all times.

Less than 1% of the bobbins broke during a year of testing. Heads on the metal spools previously used were frequently and permanently bent out of shape.

Readers' Service Item P-4

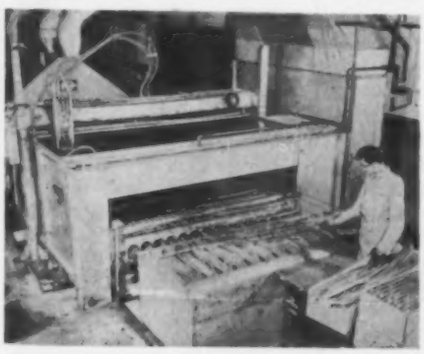
Vinyl Plastisol Stripcoat

A strippable spray coating of vinyl plastisol on highly polished chromium and stainless steel auto parts is said to save both man-hours and storage space, as well as prevent damage to parts in shipment. Plastisol films of Dennis Chemical Co.'s No. 9124-10 Denflex Heat-Fusing Stripcoat, which are based on vinyl resins supplied by Bakelite Co., can be spray-coated at rates up to 1,500 pieces per hour.

About 40 of these parts, measuring anywhere from 6-96 inches long and from ⅜-12 inches wide, reportedly can be packed in paper tubing within one hour. A coating 10 mills thick is sprayed on the parts on a conveyor feed, with excess plastisol being recovered in trays beneath the rollers. By varying the load angle, parts up to 80 inches long can be accommodated on compact equipment measuring 35 feet long by eight feet wide. Banks of infra-red lamps operating at 325° F. cure the plastisol.

The fused film is said to adhere indefinitely, yet can be peeled off easily in one piece. Dennis' coating may be applied by knife and roller, as well as by spray. For the latter method, a Model 19 Binks spray gun with a 63 PB nozzle is recommended. Suggested pressures are 15 psi. on the liquid feed line and 50 psi. on the air line. Physical properties for the formulation are reported as follows:

Solids content, %	100
Hardness, Shore A	47
Storage stability below 100° F., months	3
Viscosity, Brookfield No. 4 spindle @ 77° F. & 4 rpm, cps	12,500
At 20 rpm, cps	5,700
Fusion time, approx., min.	3
Volatile loss during fusion, %	2
Weight, lbs./gal.	10.36



Chrome strips being fed on conveyor prior to spray coating with Denflex vinyl stripcoat.

Readers' Service Item P-5

One-Component Epoxy Adhesive

A one-component, thixotropic adhesive formulation for bonding metals to metals, plastics, and other rigid materials has been released by Rubber & Asbestos Corp. Designated Bondmaster M620, the product is based on Ciba Co.'s Araldite AN-100 epoxy resin.

The new adhesive is said to give comparable physicals to the AN-100 resin, while eliminating the need for accurately measuring both resin and hardener. Bondmaster M620 offers a wide choice of practical curing cycles ranging from seven minutes at 535° F., to 1½ hours at 350° F. Still lower temperatures are possible where longer curing cycles can be tolerated in production.

Addition of a thixotropic agent eliminates drip or run before and during cure. The material has a buttery consistency, and is easily spread to the exact thickness dictated by the specific end-use. Absence of flow permits the adhesive to be applied in a vertical position or at any angle, and the glue line thickness remains the same after cure. This reportedly eliminates voids and the need for post-cleaning of bonded parts.

Bondmaster is supplied as 100% solids in one-, five-, and 55-gallon containers. Weight per gallon is approximately 9½ pounds.

Metal-to-metal bonds with new Bondmaster epoxy-base adhesive.

Readers' Service Item P-6

B-C-ted iron and reinforced plastic chairs.

Reinforced Plastic Chair Body

Unbreakable, lightweight chairs featuring wrought iron legs affixed to fibrous glass-reinforced polyester bodies have been introduced on the market by Design Manufacturing Associates, Inc. Designated B-C-ted, the chair bodies were molded by Lunn Laminates, Inc., using Barrett's Plaskon.

Whether-resistant, the chairs can be used outdoors as well as in the house or office. A rust inhibitor plus several finish coats helps prevent the iron work from rusting. The geometric pattern of the legs results in a solid unit structure which is joined to the hardwood arms. Leg pads are securely fastened to prevent dents in rugs or lawns.

B-C-ted chairs are available in avocado, tangerine, sand, and white. Weighing only 16 pounds, they are reportedly proportioned to the human form.

Readers' Service Item P-7

Polyethylene-Textile Fabric

Trilok, a new fabric which is woven flat but becomes permanently three-dimensional when dipped in boiling water, has been introduced by United States Rubber Co. Shrinkage, hitherto an undesirable feature in textiles, is used purposely under controlled conditions to achieve new patterns and textures not otherwise obtainable, and a three-dimensional depth effect.

Woven on a regular loom with polyethylene yarn and conventional textile fibers, the new fabric forms puffs when the polyethylene is shrunk by boiling water in a matter of seconds. The polyethylene, which runs lengthwise in the fabric, can shrink as much as 55%, while the fabric may be from 1/64-1 inch thick. The conventional yarns can be cotton, wool, silk, rayon, nylon, mohair, etc., or combinations of these, and can run both lengthwise (to some extent) and crosswise in the fabric. Since their maximum shrinkage (8-12%) is negligible compared to that of the polyethylene, they buckle or puff in a design determined by the weave or pattern.

Trilok can be produced as a single, double, or triple fabric, and is being made at the company's Winnsboro, S. C., mills. Applications include automotive and furniture upholstery, draperies, and carpeting.

Trilok fabric (upper) is shrunk to form puffed fabric (lower) by immersion in boiling water.

Readers' Service Item P-8

New Literature

"Marvinol VR-30." Bulletin No. 2. Naugatuck Chemical Division, United States Rubber Co. 8 pages. The physical properties, compounding, and processing of Marvinol VR-30, a straight polyvinyl chloride resin designed for calendering operations, are included in this illustrated booklet.

Readers' Service Item L-1

"The Royle Forum." No. 72, dated Sept. 15, 1955. John Royle & Sons, Paterson, N. J. This issue of the company's magazine commemorates the firm's 100th anniversary, and the 75th anniversary of the Royle tubing machine. The publication features a story, "Onward, From the Beginning," which describes the company's foundation and growth, and the history of its machinery product developments.

Readers' Service Item L-2

"The 'D' Series." Technical Bulletin #175. Claremont Pigment Dispersion Corp., Brooklyn, N. Y. 7 pages. Information is given on the properties, uses, and methods of application of the company's series of calibrated color pastes for vinyl compounding. Properties discussed include heat and light stability, migration and crocking, alkali resistance, and relative strength.

Readers' Service Item L-3

"Fibercore Molding Compounds." Plumb Chemical Corp., Philadelphia, Pa. 4 pages. This illustrated bulletin describes the company's line of polyester resin compounds containing chopped glass fibers, and gives information on design considerations, molding, shelf life, advantages, and typical applications of the materials.

Readers' Service Item L-4

"Solvent Recovery by the Columbia Activated Carbon System." Form 4410D. Carbide & Carbon Chemicals Co. 36 pages. Activated carbon and its use in the industrial recovery of a variety of solvents is the subject of this booklet.

Readers' Service Item L-5

"Kel-F Fluorocarbon Oils, Waxes, and Greases." M. W. Kellogg Co. 16 pages. The chemical and physical properties and applications of the company's series of lubricants based on polychlorotrifluorothylene are discussed in this booklet. The lubricants are said to be highly resistant to chemical attack, temperature extremes, and emulsion and physical breakdown.

Readers' Service Item L-6

"The Magic Wand Neutralizer." Technical Bulletin 126. Herman H. Sticht Co., Inc. Industrial static electricity neutralizers in general and the firm's induction neutralizer in particular are discussed in this illustrated booklet.

Readers' Service Item L-7

"Flow-Master Continuous Reactor and Mixing Assemblies." Bulletin No. 287. Marco Co., Inc. 3 pages. The firm's small pilot plant assemblies for such continuous reactions as alkylation, polymerization and copolymerization, acetylation, and sulfonation are here described and pictured.

Readers' Service Item L-8

"Outdoor Lighting with Plexiglas." Rohm & Haas Co. 16 pages. This illustrated booklet describes the fluorescent luminaire, the preferred instrument for large-area lighting when fitted with protective diffusing shields of weather-resistant Plexiglas. The quality of light delivered, and the maintenance, safety, and appearance features of the luminaires are discussed and illustrated by photos of recent installations.

Readers' Service Item L-9

"1956 Condensed Reference File." Bakelite Co. 12 pages. As with previous editions, this bulletin gives brief descriptions and typical application photographs of the company's line of resins. Materials covered include phenolic, polyethylene, fluorothene, elastomeric and rigid vinyl, acrylonitrile-styrene copolymer, polystyrene, epoxy, polyester, epoxy-phenolic, and silicone resins.

Readers' Service Item L-10

Bulletins of Koppers Co., Inc., chemical division:

"Dylan Polyethylene for Pipe Extrusion." Technical Bulletin C-5-224. 16 pages. After covering the types and strength properties of Dylans, this booklet discusses extruder equipment, die design, extrusion conditions, and other applicable information for the making of plastic pipe.

Readers' Service Item L-11

"Dylan Polyethylene for Injection Molding." Technical Bulletin C-5-225. 16 pages. Dylan 3700 is described in terms of forms and properties, injection molding conditions, finishing and assembly operations, and applications both in industry and the home.

Readers' Service Item L-12

"Spotlight on Permanence in Plasticizers." Emery Industries, Inc. 4 pages. Volatility, mineral oil extraction, and other data are given on Plastolein 9720 to show that the plasticizer imparts permanence to sheeting and coated fabrics at low cost.

Readers' Service Item L-13

"Polyvinyl Chloride Pipe Fittings & Flanges." Tube Turns Plastics, Inc. 12 pages. In addition to describing industrial applications of rigid PVC piping, this illustrated booklet gives complete specifications for the company's line of threaded and socket-types of PVC fittings and flanges, in both normal and high-impact grades.

Readers' Service Item L-14

"1956 Guide to Improved Packaging." Bakelite Co. 8 pages. This new issue of the company's bulletin describes and illustrates the latest applications of plastic film, coatings, molded and blown items, adhesives, and rigid sheets for packaging or display purposes.

Readers' Service Item L-15

"Comparative Properties of Protective Coatings." G. F. Gilbert, Jr., Atlas Mineral Products Co. 19 pages. This publication, a copy of Mr. Gilbert's talk before the National Association of Corrosion Engineers, covers coatings made of vinyl, saran, polyfluoroethylene, butadiene copolymers, chlorinated rubber, silicones, asphalt, alkyds, neoprenes, natural rubber, Thiokol, phenolic resins, furan resins, and epoxy resins. Types and properties of these coatings are described, and information is given on their selection.

Readers' Service Item L-16

Book Reviews

"Particle Size Determination." R. D. Cadle. Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. Cloth, 5 by 7¼ inches, 318 pages. Price, $5.50.

This work is the seventh in a series of Interscience Manuals which are designed to provide descriptions of laboratory procedures and methods for recording and evaluating data. Here, the book's expressed purpose is to guide the reader in choosing the appropriate technique for determining the particle size of materials from a multitude of methods.

Typical diameters of various types of particles are considered, along with the effects of size and shape on such properties as adsorption, solubility, chemical reactivity, reactions to light, and sedimentation. Another important consideration is the distribution of sizes about the average. Frequency distribution is represented graphically by a histogram, where the abscissa is the independent variable. Arithmetic mean, median and mode, geometric and harmonic means, linear mean diameters, normal distribution, and log normal distributions illustrate some of the methods for treatment of data.

A general discussion of sampling techniques is presented; covering the sampling of powders, reduction of the gross sample, sampling of suspensions, sampling of aerosols, settling and impaction techniques, thermal precipitation, filtration, and cyclone chambers. Actual methods for determining particle size are covered in some detail. These include optical microscopy, electron microscopy, sieve analysis, sedimentation and elutriation, surface area measurements, optical methods, electrostatic particle counter, diffusion, sonic methods, and bulk density.

The book is illustrated with photographs and diagrams. Tables and formulas are included together with a four-page glossary of alphabetical symbols.

"Chemical Engineering Catalog." 1955-56. Reinhold Publishing Corp., New York, N. Y. Cloth, 8½ by 11¼ inches, 1917 pages. Price, $12.50 (or may be borrowed from publisher).

This 40th annual edition of the catalog contains, as in the past, photographs, descriptions, and specifications of industrial equipment available through American manufacturers or dealers. The volume is sectionalized into six indices: company name, function of equipment, equipment and materials of construction, plants and specialized services, pilot plant manufacturers, and trade names. More than 550 equipment manufacturers and their products are contained in this latest compilation.

"Development of a Heat-Resistant Foamed-in-Place Low-Density Silicone Resin Core Material." Order PB 111555S from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 115 pages. Price, $3.

This report is supplementary to an earlier report, OTS PB 111555, which was submitted to Wright Air Development Center, U. S. Air Force by Dow Corning Corp. The most promising method for producing foamed-in-place sandwich structures from silicone resins, described herein, involves expanding a dry powdered resin which contains a blowing agent, catalyst, and inert filler.

The powder melts and expands rapidly on heating. Core density can be controlled conveniently by adjustments in the expansion temperature. A stable, multipore foam is produced, with a predominately spherical and unicellular pore structure. The foams reportedly have low moisture absorption, excellent electrical properties, and are very resistant to open flame.

Foamed-in-place sandwich panels were consistently reproduced. Thermal life for the core was reported at over 1,000 hours at 600° F., with no discernible weight loss or dimensional change. Weight loss after 72 hours at 700° F. was shown to be less than 6%, and none of the materials nor the by-products were shown to be toxic.

"Development of Heat - Resistant Foamed-in-Place Dielectric Core Materials for Sandwich Radomes." Order PB 111692 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 208 pages. Price, $5.50.

This report to the Wright Air Development Center, U. S. Air Force was compiled by Cornell Aeronautical Laboratory, Inc. Preliminary surveys failed to find a commercial resin or a foaming agent which would produce the desired core material. It was further established that the reaction between alkyd resins and isocyanates is the most reproducible method of obtaining uniform foams.

Two saturated alkyds were selected as high strength materials for applications at ambient temperatures up to 170° F.; however, the field of unsaturated alkyds reportedly proved more effective. Foams prepared from unsaturated alkyd-triallyl cyanurate copolymers retained more than 50% of their strength after soaking for ½ hour at 375-400° F.

Work on inorganic foams derived from clay and a lightweight filler showed them satisfactory at densities of 25-40 pounds per cubic foot. These materials evidenced satisfactory physical properties at temperatures in excess of 1,000° F.

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Abstracts of Important Articles

Materials

"Study of the Permeability of Polyethylene," F. Ranalli, *Mat. Plastiche*, 21, 9, 736 (Sept. 1955).

The substances examined for this study ranged from vanilla, water, alcohol, and essential oils, to benzol, xylol, and carbon tetrachloride. Kept for one year at ambient temperature in containers having walls one mm. thick and holding 500 cc., all showed more or less important losses by evaporation through the polyethylene. Tuluol, ethyl ether, and benzol were among the substances that evaporated completely in from 7-11 weeks. Among the essential oils, the losses were relatively large for oils of bergamot and nutmeg, and much smaller for oil of coriander, so that polyethylene is not recommended for the first two. Because it keeps moisture in and is permeable to carbon dioxide and oxygen, polyethylene film is particularly suited to packing vegetable products. A special advantage of this permeability to gas would be in certain cases where constant emission of volatile substance is required. The example is given of moth-proofing agents which, put in polyethylene bags, would act on garments without leaving solid particles of flakes clinging to the fabric. (In Italian).

"Crazing in Methacrylic Resins," G. Antonioli and A. Turchetti, *Poliplasti*, 3, 10, 21 (July-Aug. 1955).

The author shows that crazing in methacrylic resins is mainly due to Van der Waals forces giving way. Crazing can be reduced by: polymerizing at temperatures and for times calculated to obtain maximum molecular weight of the polymeric chains (Van der Waals forces increase with increasing molecular weight); adding to the monomer substances which will neutralize ultra-violet rays and convert them to infra-red rays; adding copolymerizing substances which will cross-link and join the molecular chains by valence forces. It can also be reduced by heat-treating the sheets of plastic, then quenching and drawing; however, heat treatment alters the optical properties of the material. (In Italian).

"The Irreversible Effects of Heat on Solid Organic Insulating Materials," C. Reimer, *Kunststoffe*, 45, 9, 367 (Sept. 1955).

While the accumulated experience of many years is available on heat resistance of natural organic insulating materials, information on the modern synthetic materials is inadequate. To avoid unsuitable applications of the latter, testing methods must be devised to provide general rules for fixing temperature limits in practical use. In addition to tear, elongation, flex, and dielectric strength test on foils, treated paper, coated tapes, insulating finishes, paper laminates, silicones, and other substances, the author discusses strain-stress diagrams, loss of substance curves, and loss factor in relation of substance curves, and loss factor in relation to temperature and time which have given a deeper insight into the structural changes of the materials due to thermal effects. It was found that to indicate approximate temperature limits, it is not enough to have data on the irreversible changes in a single property. Data on changes in many other properties are necessary. (In German).

"The Polyamides as Plastic Material," W. Ziegenbein, *Plaste u. Kautschuk*, 2, 8, 182 (Aug. 1955).

The author first surveys the history of the production of polyamides, going back to 1899 when the German chemists Gabriel and Maas made the first polyamides, down to Carothers and Schlack. The large scale production of products using caprolactam or adipic acid is treated, and processing hints are given.

Several graphs illustrate the properties of caprolactam-based polyamide. (In German).

"Results of Tests on the Behavior of Plastics in the Tropics in the Amazon Territory." M. Rauschert, *Kunststoffe*, 45, 9, 407 (Sept. 1955).

Since May 1954, the author has been carrying out investigations for a number of German and foreign firms on the effect on products of exposure to tropical conditions in the Amazon territory. PVC sheet, used as boat awnings and tent roofs, have excellent results. Unpigmented PVC bats for various purposes showed superior resistance to strong sunlight than similar articles of polyethylene, but neither material was immune to insect attacks. The rapidity with which the fabric in lined PVC becomes moldy indicates the need for adequate treatment against bacteria and fungi. Saran fabrics in every form, color, and application resisted fungus and insects. Adhesives and coatings of adhesive tapes were very susceptible to climatic conditions in the tropics. (In German).

"Morphological Study of the Rupture Phenomenon," J. Leeuwerik and F. Schwarzl, *Plastics*, 8, 9, 474, and 8, 10, 538 (Sept. and Oct. 1955).

In many materials, the mechanism of brittle fracture is closely connected with the presence in these materials of a large number of small inhomogeneities and weak spots, which determine the way in which the fracture processes develop. The present morphological studies permit interesting conclusions to be drawn as to the origin of the primary fracture, and the mechanism and rate of fracture propagation. It is suggested that control of the microstructure of materials might lead to a substantial improvement of their mechanical resistance; a result of no little economic importance. (In Dutch).

"Precondensation of Epoxy Resins," P. Bruin, *Kunststoffe*, 45, 9, 383 (Sept. 1955).

The flow and film-forming characteristics of certain stoving finishes based on epoxy resins can be improved by a method in which the final hardening reaction partially takes place during preparation of the coating. The reactions occurring during this "pre-condensation" process are described, and additional advantages are mentioned. Thus, on the basis of their structure, certain phenol-formaldehyde resins should be very suitable for combination with epoxy resin. It has not been possible to use them in this way because of their very limited compatibility with the epoxy resin, but this draw-back often can be eliminated by pre-condensation. (In German).

Processing

"The Holofol Process," W. Opavsky, *Plastverarbeiter*, 6, 8, 286 (August 1955).

The Holofol process for the mass production of seamless hollow goods from films of cellulose-ester and other thermoplastic materials, and from sheets of natural and synthetic rubber, is the exploitation of a fault in manufacture; the formation of bubbles or blisters in the interior of materials. In the process, single sheets of the materials are cut to shape and processed in a specially-designed Holofol machine; the parts first pass through baths containing a swelling agent and a certain amount of solvent, and then are heat-treated. The heat dries the entire surface and, at the same time, causes the bath ingredients that have penetrated to the interior to form gases. These gases in the interior of the material cause it to split at the exact center, while expansion of the material takes place at the same time. The method is described in its application to the three classes of substances mentioned; also its possibilities and advantages. (In German).

"Forming Contour Patterns for Molds," D. Taylor, *Canad. Plastics*, 46, (Oct. 1955).

This article outlines the common methods for successful construction from master drawings of master patterns and molds

having a good degree of accuracy and which may, if necessary, be used as primary tooling for short run productions. The materials used, developments of pattern shape, setting up of templates, laying in the plaster, and finishing the mold are described, and suggestions are given on producing matrix molds fom the finished matters.

"The Manufacture of Compression and Injection Molds for Plastics by Cold Hobbing," W. Haufe, *Plastverarbeiter*, 6, 9, 323 (Sept. 1955).

Cold hobbing is considered to be not only a very economical method of making compression and injection molds for plastics, but molds so produced also are said to give better performance than milled tools. The different steels available for the purpose, and the oil-hydraulic press required are described. Examples are given to illustrate the deformation process during cold hobbing. (In German).

"Mold Design for Injection Molding Machines," H. Gastrow, *Kunststoffe*, 45, 9, 405 (Sept. 1955).

The tear method for making tubular parts without internal threads and parts with metal inserts is discussed. (In German).

"Advances in Tumble Polishing of Plastic Parts," W. Burkart and H. Deissler, *Kunststoff-Rundschau* 2, 9, 321 (Sept. 1955).

The method of finishing small plastic parts (spectacle frames, buttons, small parts for electrical and other technical purposes, toys, etc.) by the tumbling process utilizes special grinding and polishing cubes in two sizes and separate drums for the two steps. Italian pumice and special oil are added during the grinding process, but for polishing, a new, harder, and more compact cube has been developed which not only makes the addition of burnishing powder and oil unnecessary, but gives a much higher luster, so that relatively little final buffing is necessary. In some cases no further treatment is needed. (In German).

Applications

"Some Uses of Polyurethanes in Electronics and Surface Coatings," J. Brennan, *Brit. Plastics*, 28, 10, 417 (Oct. 1955).

The use of polyurethanes for impregnating and encapsulating transformers and coils, and as potting components to resist extremes of climate and temperature are described. A typical formulation is given that includes castor oil, 2,4-mets toluylene di-isocyanate, monomeric styrene, and lactic acid as the catalyst. The effects of variations in di-isocyanate and styrene monomer are compared. Suitable compounds to give wire coatings with novel properties also are mentioned.

"Anti-Corrosion Linings of Rubber and Plastics for Chemical Apparatus," H. Anders, *Plastverarbeiter*, 6, 10, 382, (Oct. 1955).

The properties and applications of linings of natural and synthetic rubber and of a number of plastics of German and foreign origin are discussed, as well as the methods by which the linings attached to surfaces they are to protect. A table listing the most important thermoplastics for use in the construction of apparatus, and another comparing the mechanical properties of six products, including hard rubber, are included. (In German).

"Piping from Synthetic High Polymers; A New Field for Standardization," A. Melicchia, *Poliplasti*, 3, 10, 8 (July-Aug., 1955).

After reviewing the extent of present employment of piping from synthetic elastomers, for conveying water and other liquids, the author examines the existing standards for PVC piping in the United States, Germany, England, and Italy, and the work that is being done to promote international standardization. In the latter connection proposals for unification of dimensions of PVC piping, temporary standards, and testing methods for PVC and polyethylene piping for transporting water, which were put forward at the meeting of ISO/TC5 last April, are considered. (In Italian).

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. The publishers and their addresses are given below:

"ASTM Bulletin"
American Society for Testing Materials
1916 Race St., Philadelphia 3, Pa.

"Australian Plastics"
Australian Trade Publications, Ltd.
171 Sussex St., Sydney, Australia

"British Plastics"
Iliffe & Sons, Ltd.
Dorset House, Stamford St.
London S.E.1, England

"Canadian Plastics"
341 Church St., Toronto, Ont., Canada

"Chemical and Engineering News"
1155 Sixteenth St. N.W.
Washington 6, D. C.

"Hule Mexicano y Plasticos"
Filomeno Mata 13-11, Mexico, D.F.

"Industrial and Engineering Chemistry"
1155 Sixteenth St. N.W.
Washington 6, D. C.

"Industries des Plastiques Modernes"
Les Publications Techniques Associees
40 Rue du Colisee, Paris 8e, France

"Kunststoffe"
Carl Hanser Verlag
Leonard Eck Str. 7, Munich 27, Germany

"Kunststoff-Rundschau"
Brunke Garrels, Verlagsbuchhandlung
Borgfelder Strasse 83, Hamburg 26, Germany

"Materie Plastiche"
Via Farneti 8, Milan, Italy

"Matiéres Plastiques"
Galerie du Center, Bloc 3
Rue des Fripiers, Brussels, Belgium

"Mechanical Engineering"
American Society of Mechanical Engineers
29 W. 39th St., New York 18, N. Y.

"Modern Plastics"
575 Madison Ave., New York 22, N. Y.

"Oesterreichische Plastic-Rundschau"
Ployer & Co.
Aegidiengasse 5, Vienna 6, Austria

"Plaste und Kautschuk"
Veb Verlag Technik
12 Unter den Linden
Berlin N.W.7, Germany

"Plastic"
Danish Technical Press
31 Vester Farimogsgade
Copenhagen 5, Denmark

"Plastica"
Kunststoffeninstituut T.N.O.
Julianalaan 134, Delft, The Netherlands

"Plastics"
Temple Press, Ltd.
Bowling Green Lane, London E.C.1, England

"Plastics World"
Cleworth Publishing Co., Inc.
22 W. Putnam Ave., Greenwich, Conn.

"Plastiques Informations"
94 Rue Saint-Lazare
Paris 9e, France

"Plastverarbeiter"
Verlagsgec. m.b.H.
Herxheim b. Landau/Pfalz, Germany

"Poliplasti"
E.T.A.S., Via Andrea Mantegna 6,
Milan, Italy

"Revista de Plasticos"
Inst. "Alonso Barba"
Serrano 119, Madrid, Spain

"Revue Générale des Matiéres Plastiques"
196 Ave. Jean-Jaures, Paris 19e, France

"Rubber and Plastics Age"
Rubber and Technical Press, Ltd.
Tenterden, Kent, England

"SPE Journal"
Security Bank Bldg., Athens, Ohio

Patent Digest

Materials

Polymerization of Acrylonitrile in the Presence of N-Acyl Acrylamide and N-Acyl Methacrylamide Polymers. No. 2,719,138. Hugh J. Hagemeyer, Jr., and Milton A. Perry, Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N. Y.).

A mixture of 60-95 parts by weight acrylonitrile and 5-40 parts by weight of a polymer of N-acyl amide are heated in the presence of a peroxide polmerization catalyst.

Process for Polymerizing Unsaturated Compounds in an Aqueous Medium. No. 2,719,143. Christiaan Pieter van Dijk and Franciscus Johannes Fredericus van der Plas, Amsterdam, Netherlands (to Shell Development Co., Emeryville, Calif.).

A solution of the unsaturated compound is added dropwise to a liquid, non-polymerizable substance in which it is miscible. The solution is then conducted through an aqueous medium containing a water-soluble polymerization catalyst and heated. Non-polymerized monomer drops are collected and recycled.

Moisture-Resistant Regenerated Cellulose Film. No. 2,719,798. William M. Wooding, Springdale, and Tzeng Jiueq Suen, New Canaan, Conn. (to American Cyanamid Co., New York, N. Y.).

Non-fibrous, regenerated cellulose film is impregnated with urea-formaldehyde-aminoalkyl carboxylic acid resin, cured beyond its gel point, and coated with a water-repellent.

Polyvinyl Chloride-Polysulfone Resin Compositions. No. 2,719,139. John E. Wicklatz, Bartlesville, Okla. (to Phillips Petroleum Co., Bartlesville, Okla.).

A major portion of the compound consists of a PVC resin, the rest being a resin produced by the copolymerization of sulfur dioxide with an unsaturated organic compound.

Stabilized Acrylonitrile Copolymers. No. 2,719,140. Robert J. Slocombe, Dayton, and George L. Wesp, Englewood, O. (to Monsanto Chemical Co., St. Louis, Mo.).

The copolymer consists of 20-80% acrylonitrile and 20-80% of another monoolefinic monomer, with 0.01-10% magnesium alkyl maleate intimately dispersed throughout.

Process for Polymerizing Polyethylenically-Unsaturated Compounds in an Aqueous Medium. No. 2,719,142. Christiaan Pieter van Dijk and Franciscus Johannes Fredericus van der Plas, Amsterdam, Netherlands (to Shell Development Co., Emeryville, Calif.).

The unsaturated compound is polymerized at a temperature not in excess of 95° C. in a two phase system. A solution of an emulsifier in water serves as the continuous phase and the unsaturated compound acts as the discontinuous phase, so as to effect at least a 50% conversion of monomer to polymer. Polymer concentration in the reaction zone is held below the level at which gelation occurs.

Sulfur-Containing Resins from 4-Vinyl-1-Cyclohexene. No. 2,720,509. Asa C. Dees, Cushing, Okla. (to Phillips Petroleum Co., Bartlesville, Okla.).

Hydrogen sulfide and 4-vinyl-1-cyclohexene are brought together in a reaction zone in the presence of a liquid, acid type catalyst and heated. Resinous polymers ranging from light yellow viscous liquids to amber glassy solids are formed.

Copolymers and Preparation of Same. No. 2,720,511. Martin Eli Cupery and John Carl Sauer, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

The substantially linear copolymer consists of 1-30%, by weight, beta-vinyloxyethylamine and 70-99%, by weight, of an alpha-methylene monocarboxylic acid ester of an aliphatically saturated hydrocarbon alcohol. The latter has at most one substituent, an alkoxy group.

Rosin Condensation Process. No. 2,720,513. Alfred L. Rummelsburg, Chadds Ford, Pa. (to Hercules Powder Co., Wilmington, Del.).

A rosin acid, ester, or alcohol containing two ethylenic double bonds is reacted with a monoether, monoester, or ether-ester of gem-diol at 60-200° C., in the presence of an acidic siliceous clay catalyst. In this reaction the ether and ester oxygen atoms are attached to acyclic carbon atoms.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

—The Editor

Method of Preparing Cold Water-Soluble Powdered Cellulose Ethers. No. 2,720,464. Arthur W. Anderson and Bernhard V. Moeller, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

Fibrous cellulose ether, which normally gels in hot water, is completely wetted with a 0.01-1% by weight solution of sodium lauryl sulfate at a temperature above the gel point. The ether is then dried at this temperature.

Composition of Matter Comprising an Aqueous Dispersion of a Plasticized Mixture of High and Lower Molecular Weight PVA. No. 2,720,496. Collins E. Bushnell, Manheim Township, Lancaster County, Pa. (to Armstrong Cork Co., Lancaster, Pa.).

This composition comprises filler particles and a binder, the latter consisting of an aqueous mixture of the following: 100 parts by weight of PVA having a molecular weight of about 1,100,000; 5-35 parts by weight of PVA having a molecular weight of 15,000-50,000; and a plasticizer for these components.

Polytetrafluoroethylene Plasticized with Chlorofluoro Telomers. No. 2,720,498. Anthony Francis Benning, Woodstown, N. J., and Frederick Burns Hill, Jr., Llangollen Estates, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Polytetrafluoroethylene having a softening point above 327° C., is mixed with a telomeric plasticizer in the ratio of 60-91:9-40 by weight. The plasticizer can be a telomer of chloroform with chlorotrifluoroethylene or of chloroform with chlorotrifluoroethylene-tetrafluoroethylene mixtures.

Polyesters from Polycarboxylic Acids, Polyhydric Alcohols, and Glycidyl Ethers of Monohydrocarbon Substituted Monohydric Phenol. No. 2,720,500. William P. Cody, Lombard, Ill. (to Alkydol Laboratories, Inc., Cicero, Ill.).

Heat-curing polyester fluids are formed by heating and condensing a reactive dibasic acid material consisting of (a) phthalic, isophthalic, and other phthalic acids and their anhydrides; (b) saturated, open-chain aliphatic, di-basic acids and their anhydrides; and (c) saturated and unsaturated addition-reaction products of unsaturated compounds having at least one ethylenic double bond.

Organo-Magnesium Halide Catalysts for the Preparation of Polyesters. No. 2,720,503. John W. Wellman, Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N.Y.).

An aromatic dicarboxylic acid diester of the general formula $R_1OOC\text{-}R_2\text{-}X\text{-}R_3\text{-}COOR_4$ is condensed under substantially anhydrous conditions.

Organo-Metallic Titanium Catalysts for the Preparation of Polyesters. No. 2,720,502. John R. Caldwell, Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N.Y.).

The process involves condensing under substantially anhydrous conditions an aromatic dicarboxylic acid diester of the general formula $R_1OOC\text{-}R_2\text{-}X\text{-}R_3\text{-}COOR_4$.

Organo-Metallic Zirconium Catalysts for the Preparation of Polyesters. No. 2,720,504. John R. Caldwell and John W. Wellman, Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N.Y.).

An aromatic dicarboxylic acid diester of the general formula $R_1OOC\text{-}R_2\text{-}X\text{-}R_3\text{-}COOR_4$ is condensed under substantially anhydrous conditions with an alpha, omega-dioxy compound.

Polyureidopolyamides. No. 2,720,508. Sidney Melamed, Philadelphia, Pa. (to Rohm & Haas Co., Philadelphia, Pa.).

Water-soluble polyureidopolyamides are formed by reacting epsilon-caprolactam and an alkylene polyamine at 150-250° C., until a water-soluble condensate is formed. This is then heated with urea at 100-200° C., ammonia being evolved.

Rosin Condensates and Their Preparation. No. 2,720,514. Alfred L. Rummelsburg, Chadds Ford, Pa. (to E. I. du Pont de Nemours & Co., Inc., Wilmington Del.).

A rosin acid, ester, or alcohol is treated with an aldehyde or aldehyde polymer to reduce the carboxyl group. The reaction takes place at a temperature of 60-300° C., and in the presence of acidic siliceous clay.

Equipment

Molding Apparatus Having Vibrating Means. No. 2,719,346. Armando Caciagli, Milan, Italy.

The molding apparatus comprises an elongated beam and a means for vibrating it. Interrupted rails terminate adjacent to the opposite ends of the beam for carrying the mold supporting carriages and conveyor. Interchangeable molds are mounted on the carriages, and a compressing means presses downward as they pass along the beam.

Plastic Molding Machines. No. 2,719,326. Robert H. Dykehouse, Los Angeles, Calif. (to Crown Machine & Tool Co., Fort Worth, Tex.).

The machine features a plasticizing unit which may be removed from the plasticizing assembly. The assembly includes a housing formed of three sections. The inner and outer sections are connected longitudinally, and have open areas defining a plasticizing passage. The center section includes an outer annular member and an inner spreader with a plurality of arcuate openings.

Expansible Film Tensilizing Apparatus. No. 2,719,323. Walter S. Thompson, East Lansdowne, Pa. (to Milprint, Inc., Milwaukee, Wis.).

The apparatus comprises a tank for a hot liquid bath, a means for longitudinally withdrawing a film from a supply roll, an immersing means, and a withdrawal means. Still another means subjects the central area of the film to a liquid spray of higher temperature, spreading it in the process. The web is cooled while in stretched condition.

Apparatus for Reducing the Diameter of Plastic Cylindrical Bodies. No. 2,719,324. Thomas Edward Horace Gray, Sutton Coldfield, and James Jones-Hinton, Henley-in-Arden, England (to Dunlop Rubber Co., Ltd., London, England).

The mechanism comprises at least three parallel rollers mounted in slideable bearings, and disposed to grip the plastic cylinder. At least one of the rollers is rotated against the cylindrical body.

Method and Apparatus for Mixing Plastic Compositions. No. 2,719,325. Ernest M. Franklin, Stelton, N. J. (to Hercules Powder Co., Wilmington, Del.).

Plastic material is colloidized in an elongated cylindrical barrel containing a substance volatile at the colloiding temperature, and a screw worm with a cylindrical mixing torpedo. The barrel has a vent for removing vapors, heating and cooling means, and a means for developing back pressure.

Processing

Process for Gelling. No. 2,720,468. Comer Drake Shacklett, Roselle, N. J. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Thin layers of synthetic hydroxyl polymers are gelled by applying a layer of water-soluble, amorphous organo-titanium. The resulting layer is coated with a viscous, aqueous solution of water-sensitive synthetic hydroxyl polymer.

Process of Curing a Polyester Resin in a Rubber Mold. No. 2,720,004. Ellis H. Phreaner, Los Angeles, Calif.

A thermally-setting polyester resin, whose cure is inhibited in the presence of rubber anti-oxidants, is heated and brought into contact with a vulcanized rubber which contains said anti-oxidant uniformly distributed throughout.

Applications

Laminated Plastic Shuttle. No. 2,720,224. Glen W. Neely, Oak Park, Ill. (to Richardson Co., Lockland, Cincinnati, O.).

The one-piece shuttle body consists of non-oriented fibers laminated together by a resin binder. A bobbin cavity is enclosed.

Polyethylene Shoe Counter. No. 2,720,042. Robert J. Marcy, New York, N.Y. (to Endicott Johnson Corp., Endicott, N.Y.).

The shoe counter consists of a solid polyethylene which has a melt index of 0.33-200 and a melt viscosity at 190° C. of between 5×10^3 and 22×10^4 poises.

Plastic Hollow Housing Construction. No. 2,720,332. John E. Holt, Danielson, Conn. (to Danielson Mfg. Co., Danielson, Conn.).

The housing comprises two sections having cooperating lock elements at their free edges. These elements are actually extensions of the parallel walls. The outer face of each groove is inclined away from the base to receive a bonding agent which cements the sections together.

Pipe Covering. No. 2,717,848. Richard C. Jaye, Watertown, Wis. (to Jaye Corp., Watertown, Wis.).

The pipe covering consists of identical halves of cellular plastic material which fit snugly at their mating surfaces. Cohesive coating layers are protected with a layer of protective sheet material until ready for use.

Plastic Finger Pad or Cot. No. 2,717,799. Charles E. Jones, Chicago, Ill. (to Translon Co., Newark, N. J.).

The cot comprises a hollow body having a closed and blunt front end and an open rear end. The plastic body has a plurality of ventilators protruding outwardly.

Plastic Sealed Valve. No. 2,718,665. Robert Clade, Detroit, Mich. (to W-K-M Mfg. Co., Inc.).

A valve gasket having rotatable overlapping shoulders is produced by forming an annular dovetail groove in one of the shoulders, filling it with a plastic material, and applying pressure while under rotation.

Protective Surface. No. 2,718,829. Raymond B. Seymour and Robert H. Steiner, Allentown, Pa. (to Atlas Mineral Products Co., Mertztown, Pa.).

A Portland cement supporting structure is made acid and alkali resistant by adding an epoxy resin layer. Molded clay blocks are set in the resin layer, and a furfural resin is applied between the blocks.

Domestic Production and Sales of Plastics and Resin Material, July and August, 1955

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of March and April, 1955. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

Preparations for fall sales were underway, with large increases in all categories. This being the case, it is difficult to draw any conclusions as to individual trends.

	July		August	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,077,597	1,315,909	1,512,198	1,403,540
Sheets, 0.003 gage and over	753,608	978,225	1,236,903	1,209,679
All other sheets, rods, and tubes	451,996	437,319	641,203	569,659
Molding and extrusion materials	6,271,432	6,280,492	7,680,778	7,423,559
Nitrocellulose sheets, rods, and tubes	259,574	260,022	412,698	451,359
Other cellulose plastics	313,320	282,501	332,270	220,747
TOTAL	9,127,527	9,554,468	11,816,050	11,278,543
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	12,069,002	11,360,220	17,887,677	16,455,707
Bonding and adhesive resins for—				
Laminating (except plywood)	4,550,887	3,338,788	5,583,255	4,417,098
Coated and bonded abrasives	931,927	773,868	1,099,595	1,255,971
Friction materials (brake linings, clutch facings, and similar materials)	1,531,923	1,415,673	2,042,808	1,808,171
Thermal insulation (fiber glass, rock wool)	4,267,739	4,152,783	4,512,045	4,533,092
Plywood	2,961,198	1,752,300	3,285,710	2,731,196
All other bonding and adhesive uses	2,052,582	2,056,017	2,191,620	2,266,414
Protective-coating resins, unmodified and modified except by rosin	1,828,538	1,679,848	2,070,024	1,926,552
Resins for all other uses	1,922,623	1,686,650	2,484,531	2,452,753
TOTAL	32,116,419	28,216,147	41,157,265	37,846,954
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,491,123	2,328,054	3,154,619	3,037,256
Paper-treating and paper-coating resins	1,577,010	1,403,924	1,984,249	2,096,572
Bonding and adhesive resins for—				
Plywood	6,598,280	6,504,508	8,010,721	8,401,825
All other bonding and adhesive uses, including laminating	1,209,136	1,509,077	2,503,376	2,516,751
Protective-coating resins, straight and modified	2,648,863	1,928,790	3,338,641	2,422,789
Resins for all other uses, including molding	5,234,375	6,318,980	6,254,207	6,726,921
TOTAL	19,758,787	19,993,333	25,245,813	25,202,114
Styrene Resins:				
Molding materials[1]	30,015,128	25,016,828	33,931,323	31,068,927
Protective-coating resins, straight and modified	6,952,245	5,562,798	8,317,073	7,553,167
Resins for all other uses	5,733,417	5,534,936	7,212,391	7,053,522
TOTAL	42,700,790	36,114,562	49,460,792	45,675,616
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for—				
Film (resin content)		5,925,370		6,477,682
Sheeting (resin content)		3,764,786		3,358,999
Molding and extrusion (resin content)		11,943,012		13,265,299
Textile and paper treating and coating (resin content)[3]		4,290,731		5,135,925
Flooring (resin content)		3,601,146		4,599,162
Protective coatings (resin content)		2,027,715		2,104,670
All other uses (resin content)		3,540,106		4,758,970
All other vinyl resins for—				
Adhesives (resin content)		2,560,040		2,867,758
All other uses (resin content)		6,926,552		8,798,669
TOTAL	54,628,239	44,579,458	57,022,155	51,367,134
Coumarone-Indene and Petroleum Polymer Resins	20,558,348	20,001,474	22,729,089	22,989,921
Polyester Resins:				
For reinforced plastics	3,300,529	2,874,462	4,446,431	3,892,570
For all other uses	126,388	69,221	293,151	147,725
TOTAL	3,426,917	2,943,683	4,739,582	4,040,295
Polyethylene Resins	32,022,375	25,825,284	33,188,819	31,176,698
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1] [4]	2,840,500	3,189,059	3,609,175	3,248,389
Protective-coating resins[5]	318,902	206,492	293,180	241,672
Resins for all other uses[6]	6,105,194	6,073,179	6,346,606	6,313,829
TOTAL	9,264,596	9,468,730	10,248,961	9,803,890
GRAND TOTALS	223,603,998	196,697,139	255,608,526	239,381,165

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, polyethylene, nylon, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

SOURCE: United States Tariff Commission, Chemical Division.

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Lunn Laminates, Inc., Huntington Station, N. Y., will send its new 19-foot long Lunn-Plastic Truck on an extensive cross-country road tour to test the reinforced plastic truck construction. The truck, one of a series of retail delivery trucks which the company is making in large quantities, will be tested for maneuverability and "roadability"; the effects of varying weather conditions on the non-corrosive, durable, and temperature-insulating qualities of the fiberglass laminated materials; the lightweight and vibration-free characteristics; and other features.

Wiggins Plastic Molding Co., Inc., Belleville, N. J., plans to move all facilities to 30 Kingsland Rd., Clifton, N. J. The new site covers an area of 2½ acres, affording 35,500 square feet of factory space that will more than double the firm's present productive capacity.

Rohm & Haas Co., Philadelphia, Pa., reduced prices for tank-car quantities of methyl and ethyl acrylate monomers by 4¼¢ per pound, effective October 1. The new tank-car prices, on a delivered basis, are 34¢ per pound for ethyl acrylate, and 37¢ per pound for methyl acrylate.

Reichhold Chemicals, Inc., White Plains, N. Y., has confirmed the report that its merger negotiations with Catalin Corp. of America has been discontinued. Failure to arrive at a satisfactory basis of merger was given as the reason for the decision.

Wyandotte Chemicals Corp., Wyandotte, Mich., has formed three new divisions to facilitate its over-all growth and development: Michigan Alkali division, composed of the former Michigan Alkali sales and manufacturing divisions; the research & engineering division; and the general products division. The latter division includes purchasing, manufacturing, traffic, and non-chemical sales.

Koroflex Plastics, Ltd., has taken over the assets of S. Porter Products, Ltd., Brampton, Ont., Canada, manufacturers of slush molded vinyl overshoes and other vinyl protective footwear. Mr. S. Porter will remain as president of the new firm, which is expected to provide a distinctive product label and broaden the company's range within the plastics industry.

Speck Plastics, Inc., Port Washington, N. Y., has added a large, pneumatic-controlled forming press to its facilities for the corrugation of plexiglas sheeting. C-1 and C-2½ Series sheets can be accommodated in sizes up to 48 by 48 inches and 60 by 60 inches, respectively.

Current Market Prices

Price Changes and Additions

Adhesives

Pliobond 20	gal.	4.50 /	7.00
30	gal.	5.25 /	8.00

Anti-Static Agents

Merix Anti-Static #79	qt.	$0.75 /	$3.85
#79-OL	qt.	.75 /	3.85

Coating Resins

Chemigum latices	lb.	.46 /	.60
Pliolite latices	lb.	.30 /	.39
Pliolite N R	lb.	.93 /	1.22
S-3	lb.	.42 /	.44
S-5	lb.	.49 /	.51
Milled	lb.	.54 /	.56
S-7	lb.	.88 /	1.01

Colors

Mapico colors, black	lb.	.1325/	.135
Browns	lb.	.1425/	.145
Reds	lb.	.1275/	.13
Tans	lb.	.2075/	.21
Yellows	lb.	.11 /	.1175
Pliolite S-5 bases with pigment			
Blacks	lb.	.44 /	.49
Blues	lb.	.62 /	1.48
Greens	lb.	.54 /	.58
Oranges	lb.	.61 /	.63
Reds	lb.	.31 /	1.20
Whites	lb.	.42 /	.44
Yellows	lb.	.43 /	.45

Fillers

Tamms Satin Talc	ton	22.50 /	46.00
Velveteen R Silica	ton	23.00 /	28.00

Plasticizers

Admex 710	lb	.325 /	.36
711	lb.	.345 /	.38
744	lb.	.40 /	.435
Harflex 10	lb.	1.25 /	1.27
40	lb.	.64 /	.66
50	lb.	.58 /	.60
60	lb.	.62 /	.64
80	lb.	.61 /	.63
90	lb.	.88 /	.90
120, 150	lb.	.305 /	.335
140, 160	lb.	.30 /	.33
180	lb.	.295 /	.325
220	lb.	.425 /	.455
260	lb.	.42 /	.45
280	lb.	.43 /	.46
300	lb.	.63 /	.66
500	lb.	.315 /	.345
Butyl stearate	lb.	.23 /	.26
Sebacic acid, CP	lb.	.72 /	.76
Purified ???	lb.	.64 /	.68
Plastolein 9050 DHZ	lb.	.52 /	.56
9055 DGP	lb.	.28 /	.32
9057 DIOZ	lb.	.48 /	.52
9058 DOZ	lb.	.48 /	.52
9250 THFO	lb.	.3575/	.3975
9404 TGP	lb.	.38 /	.42
9715 & 9720 Polymeric	lb.	.37 /	.41

Resins & Molding Compounds

Styrenes

Plio-Tuf C75	lb.	.37 /	.40
G85	lb.	.52 /	.54

Vinyls

Exon 402A, 500, 905, 915, 925	lb.	.31 /	.51
450, 468R, 480	lb.	.35 /	.55
461	lb.	9.75	
468	lb.	.33 /	.53
470	lb.	.55	
471	lb.	.50	
654	lb.	.34 /	.54
Pliovic AO (dispersion)	lb.	.34 /	.36
DB80V, DB90V, EDB90V	lb.	.31 /	.33
Latex 300	lb.	.30 /	.48

Solvents

Enjay acetone	gal.	.07 /	.10
Isopropyl acetate	gal.	.105 /	.135
Methyl ethyl ketone	gal.	.115 /	.145
Secondary butyl acetate	gal.	.1125/	.1425
Butyl alcohol	gal.	.115 /	.145
Petrohol 91%	gal.	.37 /	.37
95%	gal.	.39 /	.39
99%	gal.	.41 /	.61

Stabilizers

Merix AST Concentrate 1001	lb.	.355 /	1.75

Dow Chemical Co., Midland, Mich., has announced a reduction in the price of tank car and tank truck shipments of styrene and vinyltoluene monomers ranging from 0.5-20.5¢ per pound. In addition, Dow is allowing freight on shipments.

Diamond Alkali Co., Cleveland, O., has announced the formation of Diamond Chemicals of Puerto Rico, Inc. The new subsidiary's plant is located at 178 Elzaburu St., Hato Rey, a suburb of San Juan.

Dow Chemical Co., Midland, Mich., has announced the re-election of all incumbent officers at the August 24 board of directors meeting. Additionally, Carl A. Gerstacker, treasurer, was named a vice president and Robert B. Bennett, assistant secretary, was made assistant treasurer and appointed to the company's finance committee.

United Chromium Division, Metal & Thermit Corp., New York, N. Y., has appointed the following eight firms as additional franchised applicators of its sprayable plastisol, Unichrome 5300: Barber-Webb Co., Los Angeles, Calif.; Crane Equipment & Supply Co., Waterbury, Conn.; Kaybar, Inc., Detroit, Mich.; Lithcote Corp., Norwalk, Conn.; Metal Cladding, Inc., Buffalo, N. Y.; Metal Weld, Inc., Philadelphia, Pa.; Paterson Rubber Co.; and Rack Processing Co., Dayton, O.

Monsanto Chemical Co., St. Louis, Mo., has announced increased production and storage facilities for phthalate esters at its plant in Everett, Mass. Best estimates are that the plant will be turning out 50% more of these products by January 1. Storage capacity for muriatic acid and marketable plasticizers also has been increased by several hundred thousand gallons.

(Continued on next page)

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Dow Chemical Co., Midland, Mich., has reduced the price of its styrene N99 and styrene H99, polymer grades of monomer, to 20½¢ a pound; and styrene RG, the rubber grade of monomer, and vinyltoluene to 17¢ a pound. Sold previously on an f.o.b. basis, these monomers are now shipped freight allowed.

Mosanto Chemical Co.'s plastics division, Springfield, Mass., is sponsoring a "Trip to Disneyland" toy contest. Part of a nationwide plastic toy promotion, the contest will be nationally advertised on the children's TV program "Winky Dink and You," from November 12 to Christmas.

Lucidol Division, Wallace & Tiernan, Inc., Buffalo, N. Y., has appointed Van Waters & Rogers, Seattle, Wash., as sales representative for its organic peroxides on the West Coast.

Bolta Products, Textileather, and Jeanette, divisions of the General Tire & Rubber Co., Akron, O., are sponsoring an auto seat cover promotion known as the "Magic Seat Cover Contest." Intended to stimulate a demand for plastic seat covers, the contest features an all-expense paid trip for two to anywhere in the world as first prize.

Dow Chemical Co., Midland, Mich., has announced that commercial grades of vinylidene film, as well as the household roll, will be designated as Saran Wrap. This is expected to give positive indentification to saran films in all forms.

Roger Williams Technical & Economic Services, Inc., New York, N. Y., industrial market research consultants for the chemical industry, has authorized the construction of new executive offices near Princeton, N. J. New York City offices will be maintained, however, for the convenience of clients.

B. F. Goodrich, Marietta, O., has introduced two new Koroseal vinyl upholstery material patterns. The first, called Seersucker, is of 22-ounce construction, drill backed, 54 inches wide, and available in six colors. The other, Rope Square, is of 25-ounce construction, 54 inches wide, and made in 12 colors.

Monsanto Chemical Co.'s plastics division, Springfield, Mass., has issued a new sound-color film, "The World That Nature Forgot," a documentary of the plastics industry that is the second in the company's adventure-in-science series. In addition to scenes showing how basic resins are converted to sheets, powders, and crystals for molding and fabrication, the motion picture features a "molecule ballet" which uses colored models to depict how scientists imagine molecules behave.

Tech-Art Plastics Co., Morristown, N. J., is organizing a merchandising division to market its new four-color lithography process ash trays and dishes, already in production. The company's custom molding division will handle industrial uses of the process, including instrument dials, radio and TV tuning panels, and machinery and appliance name plates, instructions, and diagrams.

Positions Open

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CALENDAR of COMING EVENTS

December 21
SPE New York Section December Gala, Gotham Hotel, New York City.

January 4
SPE Western New England Section, Bradley Field, Windsor Locks, Conn.

January 5
SPE Southern California Section, Scully's Restaurant, Los Angeles, Calif.

January 9
SPE Cleveland Akron Section, Spanish Tavern, Brecksville, O.

January 11
SPE Newark Section, Military Park Hotel, Newark, N. J.

January 18-20
SPE 12th Annual Conference, Hotel Statler, Cleveland, O.

January 25
SPE Quebec Section, Queens Hotel, Montreal, Can.

February 9
Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

February 7-9
SPI 11th Annual Reinforced Plastics Conference, Hotel Chalfonte-Haddon Hall, Atlantic City, N. J.

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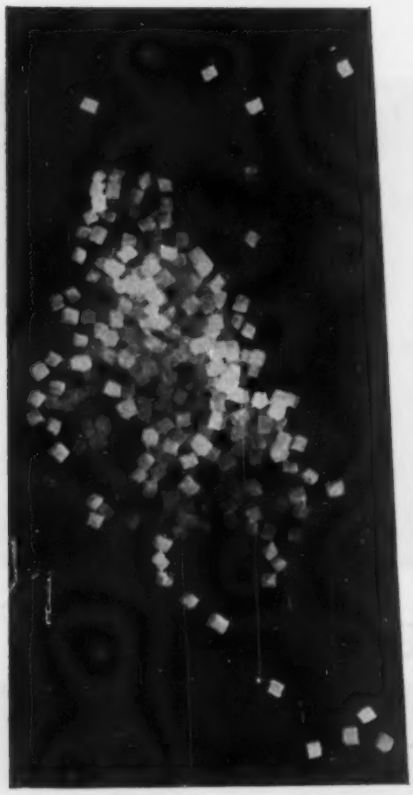

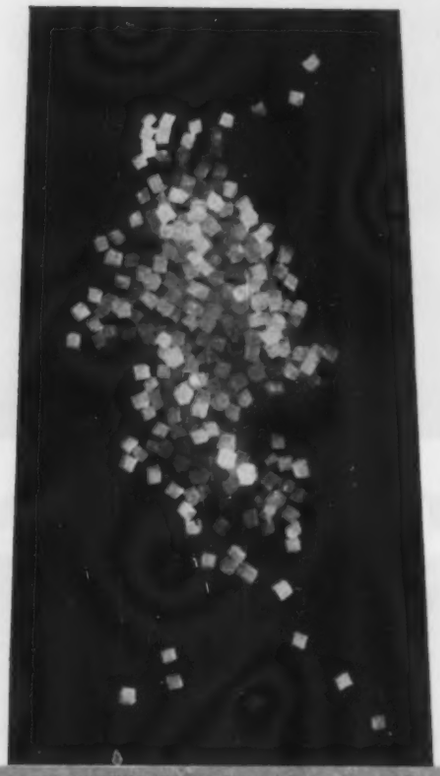

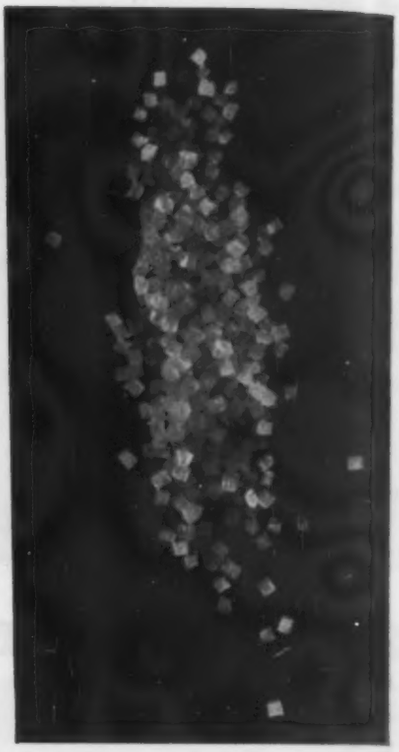

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Bulk Factor	D-1182-51T	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Brittleness Temp., °C.	D- 746-52T	<—70	<—70	<—70	<—70	—	—	<—70
Specific Gravity	—	0.92	0.92	0.92	0.92	—	—	0.92
Tensile Strength	D- 412-51T							
Yield Point, psi		1320	1320	1320	1250	1200	1250	1320
At Fracture, psi		1800	1800	1750	1650	1250	1500	1750
Elongation, %	D- 412-51T	540	540	540	520	480	490	540
Tear Resistance lbs. per inch Thickness	D-1004-49T	540	540	535	—	—	—	535

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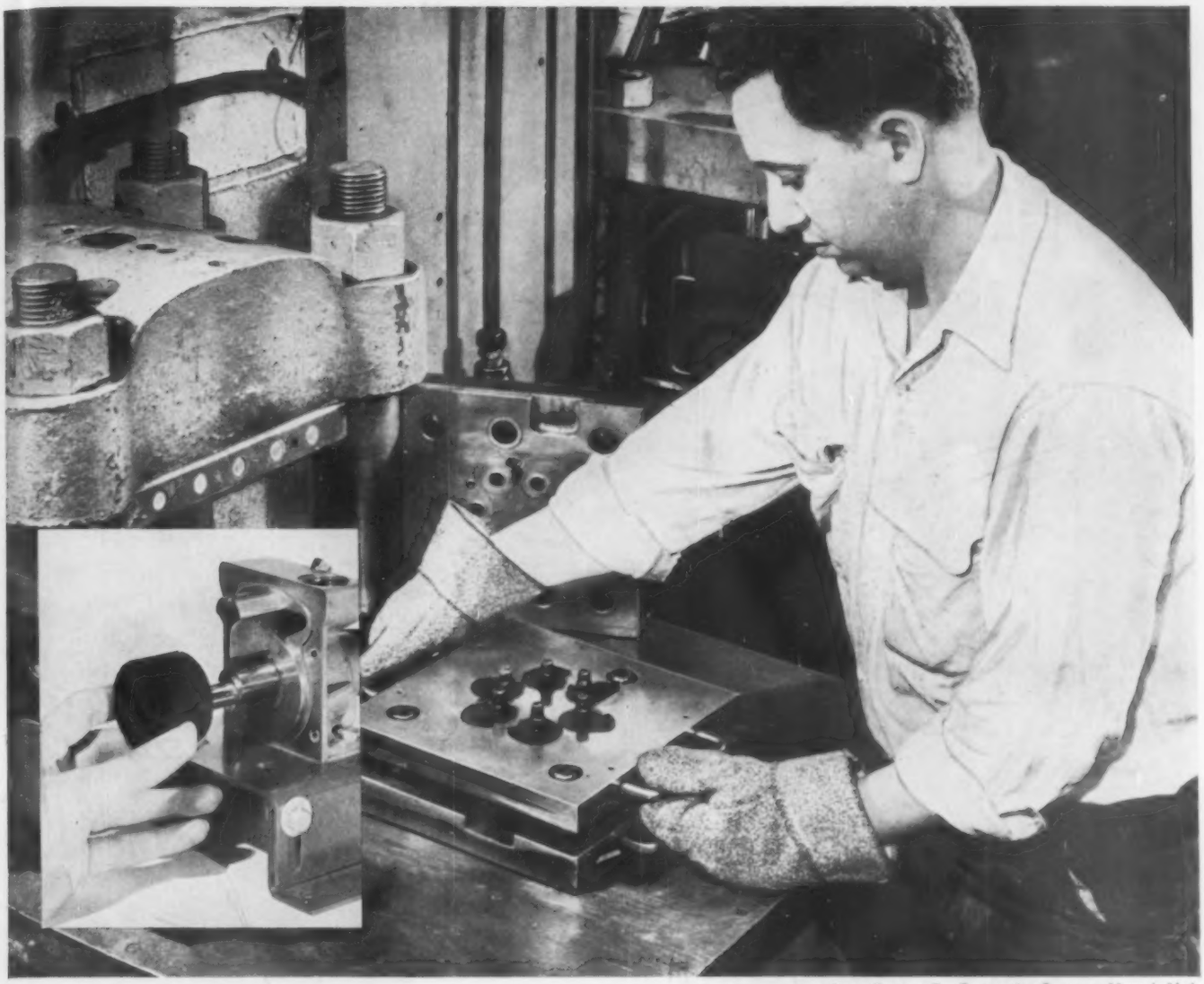

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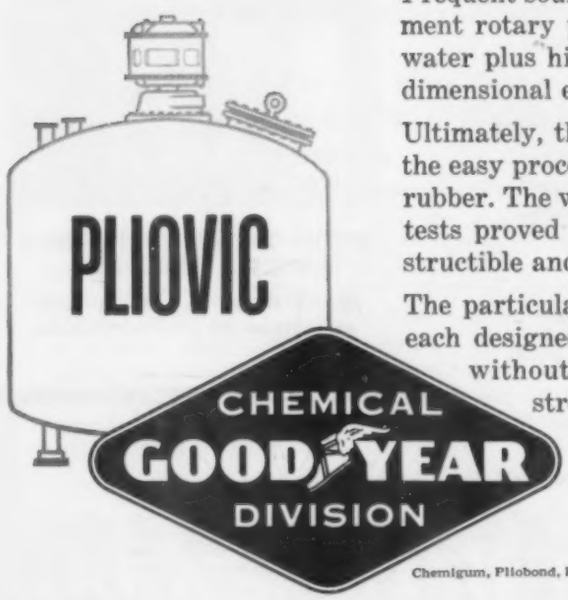

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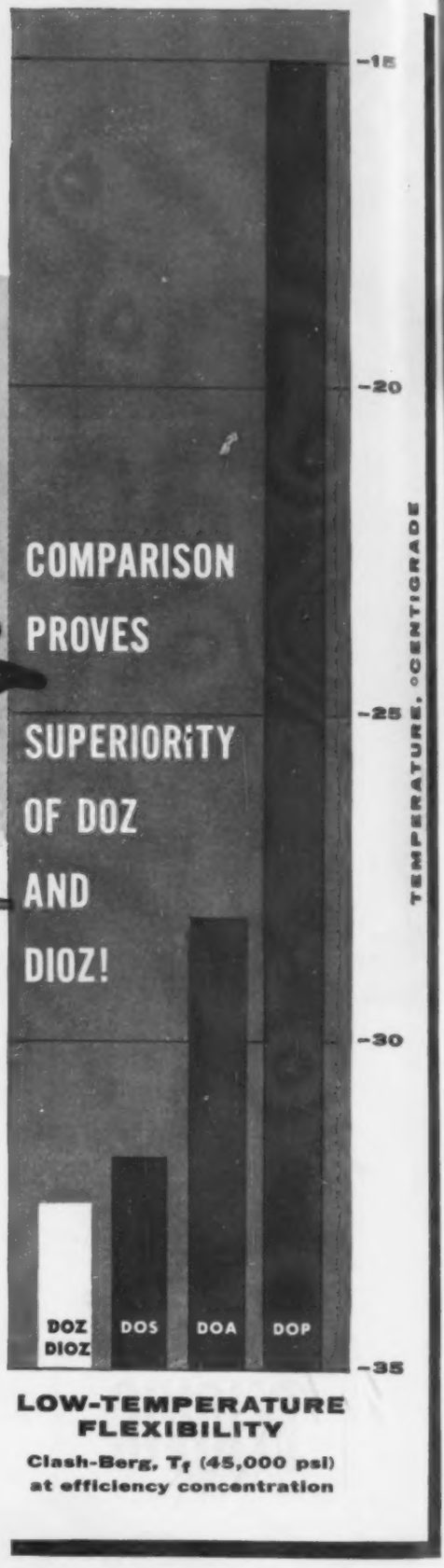
LOW TEMPERATURE FLEXIBILITY



SPECIFY PLASTOLEINS® 9058 DOZ AND 9057 DIOZ

Eskimos and their low-temperature problems aside–what about yours! Fabricators of plastic items will be more receptive to your vinyl products if you can offer them superior low-temperature flexibility . . . like that provided by Plastoleins DOZ and DIOZ.

In addition, these Emery Plasticizers give many other advantages to calendered and cast films, calendered sheeting, calendered and dispersion coated fabrics, and extruded products. They provide low volatility, low water extraction, excellent heat and light stability, high plasticizing efficiency and extremely low soapy-water extraction.

Find out how you can make your products more attractive sales-wise. Today, write to Dept. PT-12 for descriptive literature and samples of Plastolein 9058 (di-2-ethylhexyl azelate) or Plastolein 9057 DIOZ (di-iso-octyl azelate).

Emery

Fatty Acids & Derivatives
Plastolein Plasticizers
Twitchell Oils, Emulsifiers

Emery Industries, Inc., Carew Tower. Cincinnati 2, Ohio

New York • Philadelphia • Lowell, Mass. • Chicago • San Francisco • Cleveland

Warehouse stocks also in St. Louis, Buffalo, Baltimore and Los Angeles

Export: 2205 Carew Tower, Cincinnati 2, Ohio

SILICONE EMULSION

HSC-35

A BETTER MOLD RELEASE AGENT *and* LUBRICANT THAT SAVES TIME *and* CUTS PRODUCTION COSTS

- ✔ ON TIRE MOLDS AND CARCASSES
- ✔ IN CURING BAG DIP TANKS
- ✔ ON MOLDS FOR MECHANICAL GOODS
- ✔ ON RUBBER SOLES AND HEELS
- ✔ ON VINYL FLOOR TILES
- ✔ ON HIGH-LOADED THERMOSETTING COMPOUNDS
- ✔ ON SHALLOW-DRAW MOLDS WITH ALL TYPES OF COMPOUNDS

HSC-35 is a 35% oil-in-water emulsion of Silicone Mold Release Oil, developed to assure the most efficient use of the active ingredient. . . . As a mold and bag dip lubricant it has proved outstanding as a release agent, keeping molds cleaner and surface-finish of products free from deposit or stains . . . HSC-35 possesses unusual stability to "creaming" and phase separation . . . It is being used with remarkable success on all types of molds for mechanical goods, soles and heels, on mandrels and under extruded lead, on vinyl tile presses, in the treatment of cloth and paper used for polishing and in the treatment of glass fibers to render them water-repellent. Many other successful applications establish the broad versatility, economy and efficiency of HSC-35.

**Write for complete data.*

HARWICK STANDARD CHEMICAL CO.

AKRON, BOSTON, TRENTON, CHICAGO, LOS ANGELES

Season's Greetings

Cabot produces the non-toxic plasticizer Cabflex Di-BA but does not make the finished film or articles pictured.

PLASTICS CHEMICALS DIVISION

CABOT GODFREY L. CABOT, INC., Boston

CABFLEX®Di-OP (di-iso-octyl phthalate)
CABFLEX®DOP (di-2-ethylhexyl phthalate)
CABFLEX®ODP (iso-octyl decyl phthalate)
CABFLEX®DDP (di-decyl phthalate)

CABFLEX Di-OA® (di-iso-octyl adipate)
CABFLEX®DOA (di-2-ethylhexyl adipate)
CABFLEX®ODA (iso-octyl decyl adipate)
CABFLEX®DDA (di-decyl adipate)

CABFLEX®Di-OZ (di-iso-octyl azelate)
CABFLEX Di-BA® (di-iso-butyl adipate)
CABFLEX®TCP (tricresyl phosphate)